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A 757,631 DUPL
SWITCH LAYOUTS
CURVE EASEMENTS

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1896

SWITCH LAYOUTS

SHOWING GRAPHICALLY THE LEADS, OFFSETS AND ALL DIMENSIONS NEEDED
FROGS OF ALL NUMBERS AND CURVES IN ALL SWITCHES IN COMMON

CURVE EASEMENTS

TABLES OF ANGLES, CHORDS AND DEFLECTIONS FOR EASING THE TRANSITION FROM
TO A CURVE, AND FROM A CURVE OF ONE RADIUS TO A CURVE OF ANOTHER RA

BY

AUGUSTUS TORREY,
PRINCIPAL ASSISTANT ENGINEER, MICHIGAN CENTRAL RAILROA

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1896.

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SWITCH LAYOUTS.

Explanation of Diagrams for Laying Out Switches and Crossovers
Table of Frogs and Leads . . . . . .
Single Split-Switches . . . . . .
Double Split-Switches . . . . . .
Single Stub-Switches . . . . . .
Double Stub-Switches . . . . . .
Locations of Frogs in Crossovers . . . . . .
Middle Ordinates for Bending Ralls . . . . . .

CURVE EASEMENTS.

Explanation of Plates, Cases and Tables . . . . . .
Plates I. to VII.: Functions of Transition Curves . . . .
Cases I. to IV.: Calculations for Tangent Lengths, Radii and Easer
Tables I. to X.: Functions of Transition Curves for Chords 100 ft. tc
15' Variation

LAYING OUT SWITCHES AND CRC

The theoretical point of a frog may be found as
place where the frog is 4 inches wide from gauge to ga
beginning, measure toward the point 4 times as many
ber of the frog. Mark the wing rail opposite, and the
opposite the theoretical point of frog.

The figures given in the diagrams for the leads (dist
of the frog to the head-block) to frogs in straight main t
in the curved main track, provided the main track for
within the limits of the lead, except as to the degree o

When the frog is in the outside rail of the curve of
degree of curve of the lead will equal the degree of

ack *minus* the degree of curve of the lead given in the diagram. Wh
e frog is in the inside rail of the curve of the main track, the degree of
urve of the lead will equal the degree of curve of the main track *plus*
he degree of curve of the lead given in the diagram.

In calculating the lengths and curves of leads the stiffness of frogs near the points has been considered, and for this reason it has been assumed that the legs of frogs cannot be bent nearer to the point than 3 ft. The recognition of this fact is of especial importance in the case of a nest of frogs coupled so closely together as they are in some of the combinations shown in the diagrams.

Lead rails and the unbolted part of the legs of frogs should be bent to the proper curve before being spiked down, and for this purpose a table ding rails of any length to any degree of curve is given.
hown at different points on the drawings of the layouts
e side of the rails. These offsets are exactly
cords with its reputed number and
gon in its diagram require.

In using the figures from the diagrams, the lead and measure the partial distanc frog toward the head block. If made stri these partial distances, the offsets given c lead which is exactly right, if the angle nearly right if the angle of the frog is nea enables a man with an unpracticed eye tc also avoids the necessity for lining the ra

Ties should be laid in the same order and with 20-in. centres, unless such spac nections or the proper spiking of the joi the tie on any road is longer or shorter th added to or taken from the lengths of the

The figures given for split switches a ft. long with a $5\frac{3}{4}$-in. offset from the stoc The planing of 15-ft. points varies, how affects the angle made with the stock-r

lengths of lead and intermediate offsets will be applicable to most of the 15-ft. points in use.

In split switches the point-rail is that part of the lead which turns the truck most abruptly. For that reason it has not been thought advisable to consider a point-rail which makes a sharper angle than the one shown in this work. Fifteen feet is an economical length at which to cut points, and 5¼ in. allows room for a spike at the heel of the point-rail when its base does not exceed 5 in. It does not ease the transition from the main track to the curve of the lead, nor does it lessen the curvature of the lead appreciably, to curve the point-rails on their unplaned portion. In consequence the point-rail has been considered straight throughout its whole length in these calculations. With the point-rails turned for the side track, it is probable that the heel of the planed portion will not always touch the stock rail if the joint at the heel of the point-rail is fully bolted, but the passage of a truck will have the effect of forcing it there, making the point-rail tangent to the curve of the lead, although its appearance may not indicate it when the switch is not in use.

In the diagrams of combinations consisting of two
three frogs, that diagram is first given which provides
clear room for attaching rod No. 1 to the second switc
rail has a base, and the switch-stand a throw, of not to
the case of a narrower rail-base, or less throw to the switc
ance is of course greater, but 2 in. will admit of a special
tion without interfering with the point-rail of the first sw
ceeding page will be found a diagram of a combinatic
takes up less room in the track, but which requires tha
lead-rail of the first switch shall be cut away to allow
sage of the head-rod of the second switch. From an i
combinations, which are designed in such a way as to pr
of ordinary frog angles, it will be seen that many of the
for general use on account of the close or special work n
ling the frogs together and for arranging the wing-rails.

In cases where both switches turn toward the same
track, it is evident that one of the tracks shown in the di

out from the main track becomes the *main track*, and the degree of curvature of the first lead equals the sum of the degrees of curvature of both leads in the table. The other dimensions, although not mathematically exact for this change, are practically so if the main track is a straight line or a simple curve. It is important to notice in the diagram which frog is ahead, although it does not matter on which side of the track it is.

The leads of stub switches are computed on the same premises with regard to frogs as are the leads of split switches. The moving rail is in no case regarded as moving more than 22 ft. back from the head-block, and has a switch stand throw of 5 in. If more rail than 22 ft. is left unspiked it is unlikely that it will be affected by the movement of the switch-stand. While it is probable that the moving rail will in practice assume a curve differing somewhat from a circular curve, it has been regarded as a simple curve in these calculations, either of the same degree as the rest of the lead, or of that degree due to a deflection of 5 in. from a straight line in 22 ft.

of split switches are true of 3-throw stub switches, which latter, however, are for many economic reasons to be avoided if possible. The lengths of leads given in the diagrams differ a little from some in use, mainly because the rigidity of the frog is regarded as a necessary factor in these calculations. If the leads of the switches given are shortened the degree of curvature is evidently increased, while if the leads are lengthened, a portion is just as positively, though perhaps less evidently, increased in degree of curvature. The simple curve which unites the tangent at the frog with the tangent of the switch-rail at the switch-stand is therefore the easiest and the best line to follow.

The diagrams showing the positions of frogs in crossovers give the proper location of the frogs when the main tracks are straight and connected by a piece of straight track, or when the main tracks are curved, and the frogs are connected by a piece of track whose degree and direction of curvature is the same as that of the main tracks.

Owing to the condition, in the leads of frogs of small angles, that the point rail makes a much greater deflection from the stock rail than the

of the lead curve would make, it follows that the lead from point of switch to frog is virtually a compound curve with its sharper portion at the point end. This compound curve of lead sometimes becomes a reversed curve when a frog is in the outside rail of a curve sharper than the lead of a similar frog in straight track, and the lead will look awkward when the above limit of curvature of main track is approached. A remedy for this awkward appearance, which can be applied in many cases, is to reduce the bend in the stock rail and put the balance of the bend in the opposite rail of main track, which is ordinarily kept straight. This introduces a compound curve in the main track between the frog and the bend, and the offsets to lead given in the table will not apply exactly, but the standard length of lead will be nearly enough correct. It follows from the foregoing that a wide frog generally looks better on the outside of a curve, and that it is advisable in a combination of frogs to put the wider one in the outside rail of a curved main track.

TABLE OF FROGS AND LEADS.

GAUGE 4 FT. 8½ IN. (4.71 FT.). MEASUREMENTS IN FEET AND TENTHS OF A FOOT.

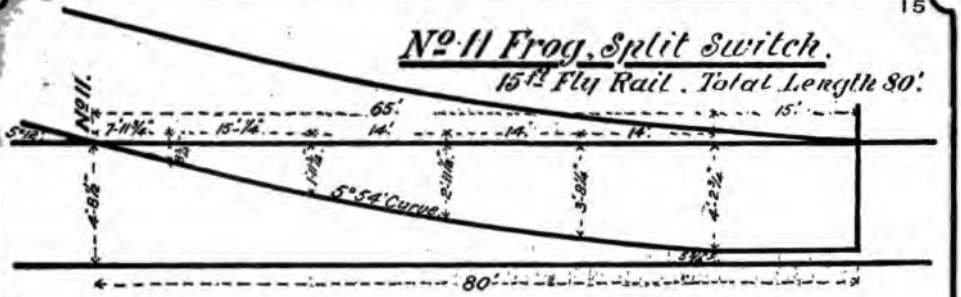
No. of frog.	Frog angle.	SPLIT SWITCH.			STUB SWITCH.				No. of frog.
		Lead H.B. to Frog.	Fly rail.	Deg. of curve.	Total dist. on rail.	Switch rail.	Lead H.B. to Frog.	Deg. of curve.	
4	14° 25′	42.28	15.0	52° 51′	34.67	10.40	24.27	45° 36′	4
5	11° 25′	49.23	15.0	30° 44′	44.12	13.21	30.91	27° 49′	5
6	9° 32′	55.47	15.0	20° 31′	53.45	16.00	37.45	19° 09′	6
7	8° 10′	61.45	15.0	14° 33′	62.98	18.83	44.15	13° 36′	7
8	7° 9′	67.12	15.0	10° 48′	72.45	21.65	50.80	10° 17′	8
9	6° 22′	72.43	15.0	8° 18′	77.92	22.00	55.92	7° 55′	9
10	5° 44′	77.41	15.0	6° 33′	82.64	22.00	60.64	6° 8′	10
11	5° 12′	80.00	15.0	5° 54′	87.00	22.00	65.00	4° 54′	11
12	4° 46′	87.01	15.0	4° 15′	91.52	22.00	69.52	3° 52′	12

Switch Ties 20" centre to centre.

1 Head Block	8"x16"x16' long.
7 Ties	6"x10"x 9' "
9 "	6"x10"x10' "
12 "	6"x10"x11' "
10 "	6"x10"x12' "
8 "	6"x10"x13' "
7 "	6"x10"x14' "
3 "	6"x10"x15' "

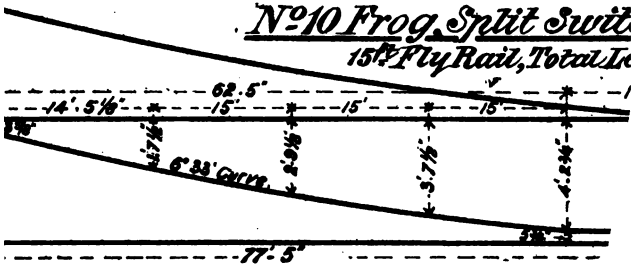
No. 11 Frog, Split Switch.

15 ft Fly Rail. Total Length 80'.



Switch Ties 20" centre to centre.

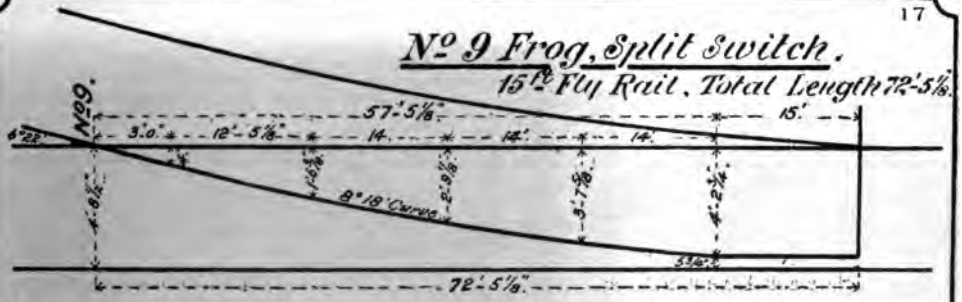
1	Head Block	8" × 16" - 15' long.
7	Ties	6" × 10" - 9' "
11	"	6" × 10" - 10' "
10	"	6" × 10" - 11' "
8	"	6" × 10" - 12' "
8	"	6" × 10" - 13' "
8	"	6" × 10" - 14' "



Sleepers Ties 20" centre to centre.

Nº 9 Frog, Split Switch.

15ft Fly Rail. Total Length 72'-5⅛"

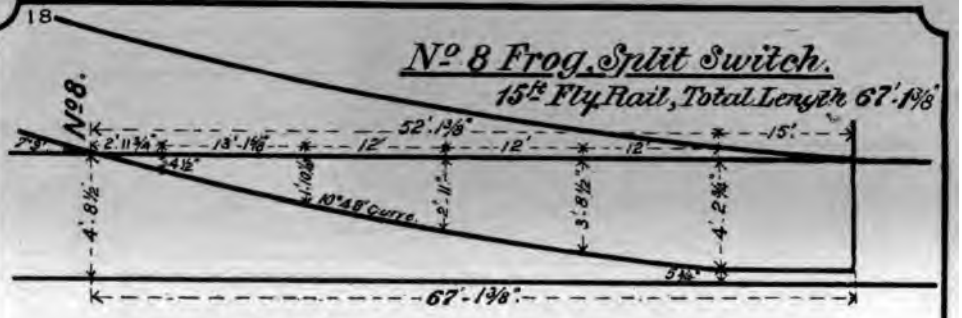


Switch Ties 20" centre to centre.

1 Head Block	8" × 16"	16' long.
7 Ties	6" × 10"	9' "
11 "	6" × 10"	10" "
9 "	6" × 10"	11' "
7 "	6" × 10"	12' "
6 "	6" × 10"	13' "
5 "	6" × 10"	14' "
2 "	6" × 10"	15' "

No. 8 Frog. Split Switch.

15ft Fly Rail, Total Length 67'-1⅜"

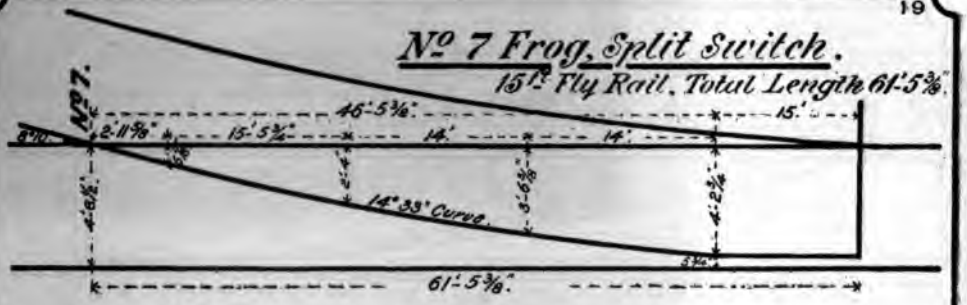


Switch Ties 20" centre to centre.

1 Head Block	8"x16"x16' long.
7 Ties	6"x10"x 9' "
6 "	6"x10"x10' "
10 "	6"x10"x11' "
8 "	6"x10"x12' "
5 "	6"x10"x13' "
5 "	6"x10"x14' "
3 "	6"x10"x15' "

No 7 Frog, Split Switch.

15ft Fly Rail. Total Length 61'-5⅜".

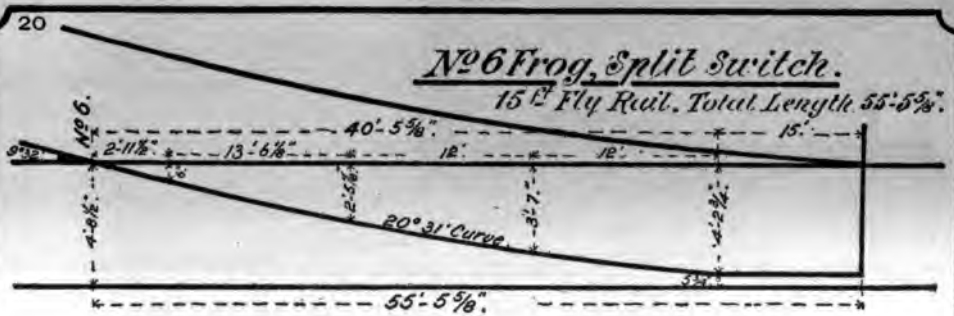


Switch Ties 20" centre to centre.

1	Head Block	8" × 15" – 16' long.
7	Ties	6" × 10" – 9' "
9	"	6" × 10" – 10' "
7	"	6" × 10" – 11' "
6	"	6" × 10" – 12' "
5	"	6" × 10" – 13' "
4	"	6" × 10" – 14' "
2	"	6" × 10" – 15' "

No 6 Frog, Split Switch.

15 ft Fly Rail. Total Length 55'-5⅝".

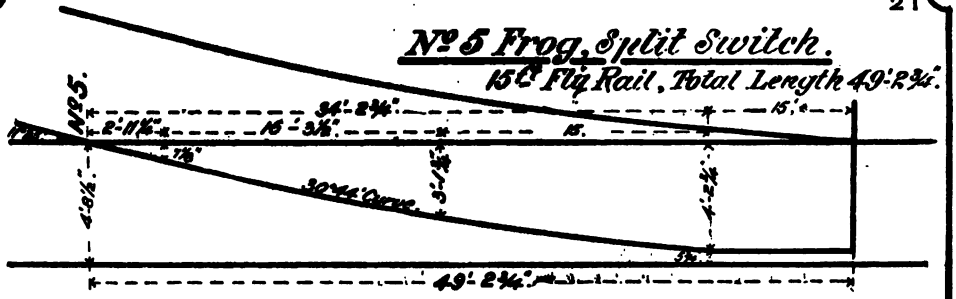


Switch Ties 20" centre to centre.

1 Head Block	8" × 16"	16' long.
7 Ties	6" × 10"	9' "
8 "	6" × 10"	10' "
7 "	6" × 10"	11' "
5 "	6" × 10"	12' "
4 "	6" × 10"	13' "
3 "	6" × 10"	14' "
3 "	6" × 10"	15' "

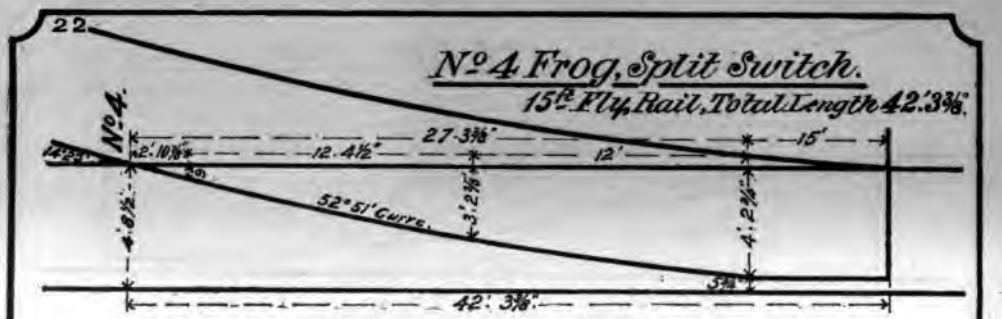
No 6 Frog, Split Switch.

15 Cª Fly Rail, Total Length 49'-2¾".



Switch Ties 20" centre to centre

1 Head Block	8" x 16" - 16' long.	4	Ties	6" x 10" - 12' long.
7 Ties	6" x 10" - 9' "	4	"	6" x 10" - 13' "
8 "	6" x 10" - 10' "	3	"	6" x 10" - 14' "
4 "	6" x 10" - 11' "	3	"	6" x 10" - 15' "

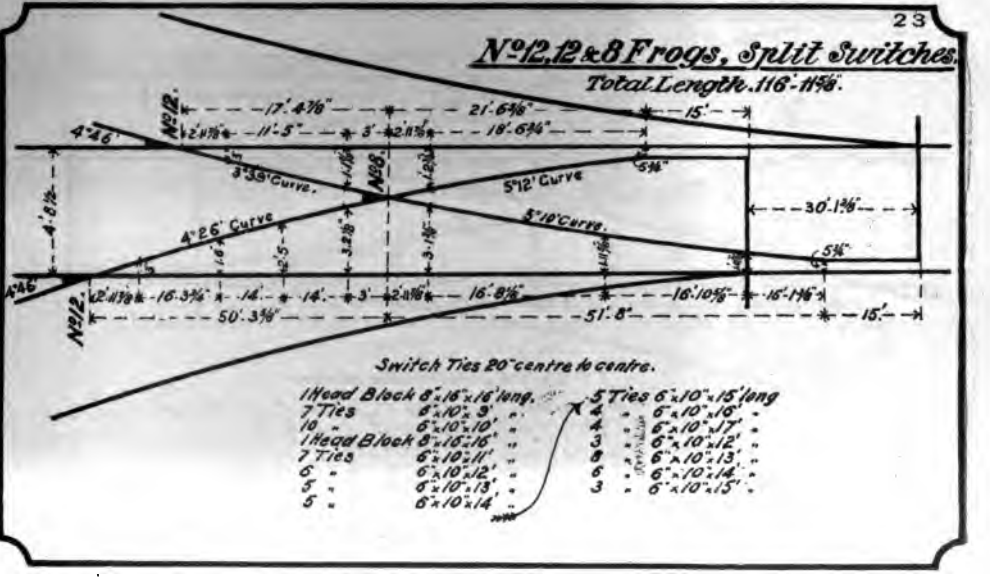


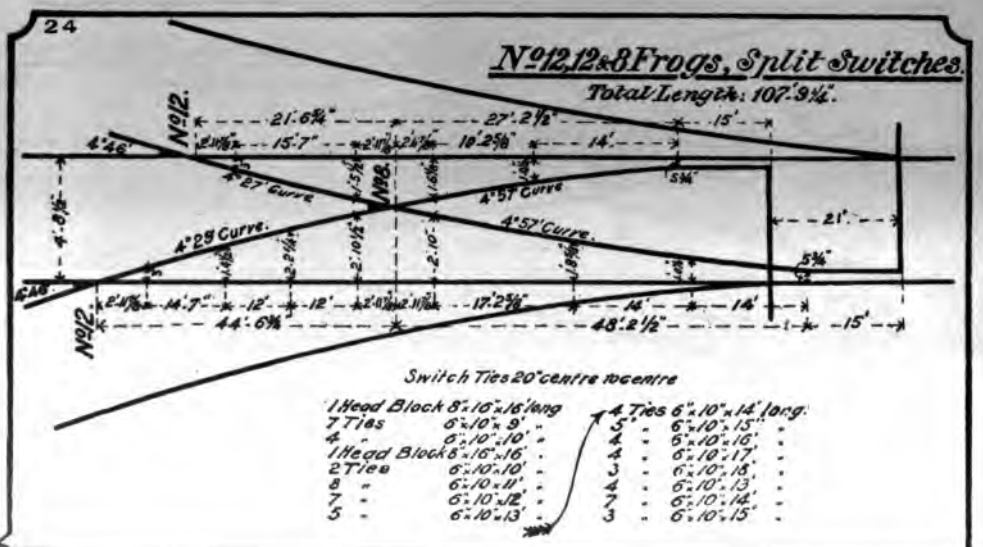
Switch Ties 20" centre to centre.

1	Head Block	6"x10"x16' long.
7	Ties	6"x10"x 9' "
6	"	6"x10"x10' "
4	"	6"x10"x11' "
4	"	6"x10"x12' "
2	"	6"x10"x13' "
2	"	6"x10"x14' "
2	"	6"x10"x15' "
2	"	6"x10"x16' "

No 12, 12 & 8 Frogs, Split Switches.

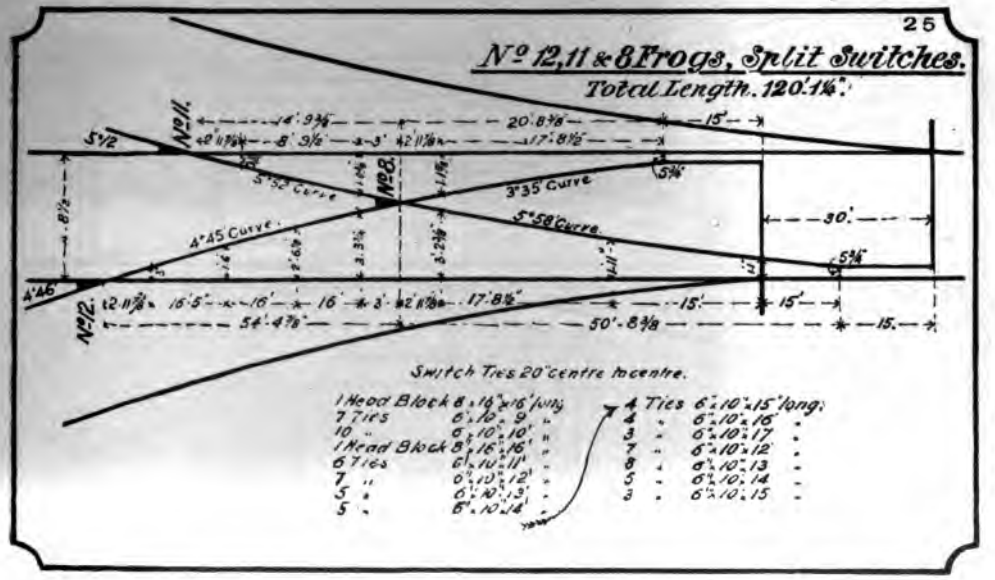
Total Length. 116'-11⅝".

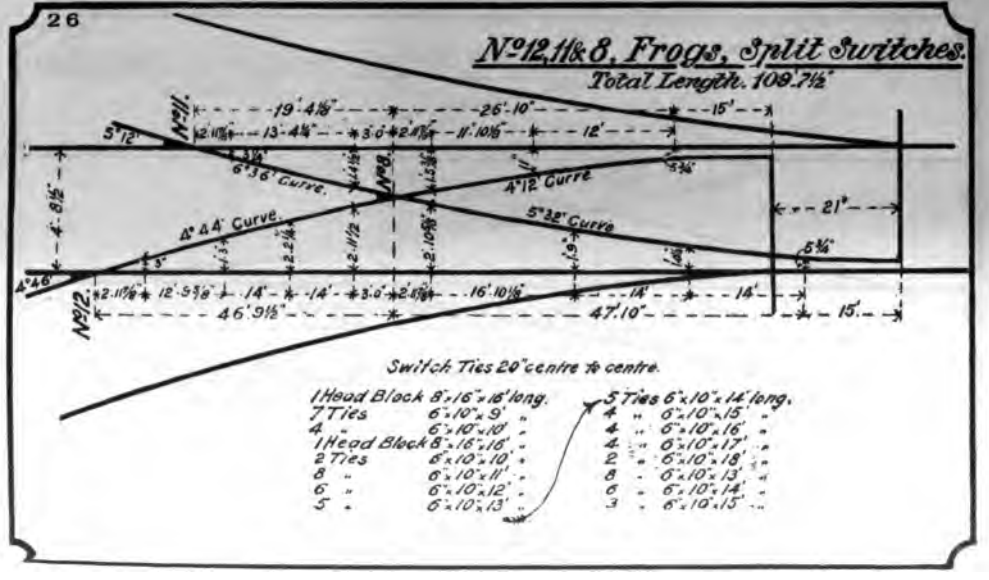


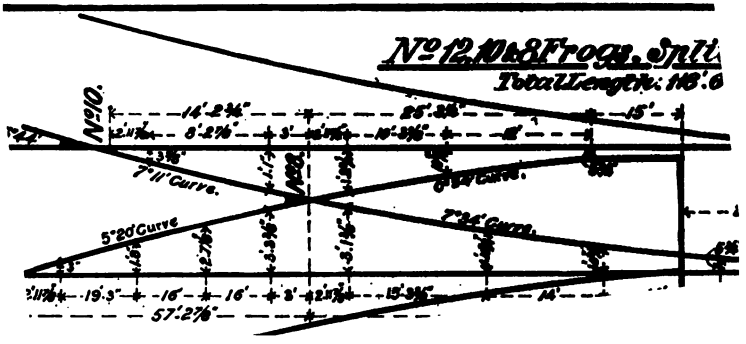

No 12, 12 & 8 Frogs, Split Switches.
Total Length: 107'-3½".
No 12.
No 8.
No 12.
4°46'
4°27' Curve.
4°29' Curve.
4°51' Curve.
4°57' Curve.
21'-6¾"
27'-2½"
15'
15'-7"
10'-2⅝"
14'
21'
14'
14'
15'
44'-6¾"
48'-2½"
Switch Ties 20" centre to centre
1 Head Block 8"×16"×16' long
7 Ties 6"×10"×9'
4 " 6"×10"×10'
1 Head Block 8"×16"×16'
2 Ties 6"×10"×10'
8 " 6"×10"×11'
7 " 6"×10"×12'
5 " 6"×10"×13'
4 Ties 6"×10"×14' long
5 " 6"×10"×15'
4 " 6"×10"×16'
4 " 6"×10"×17'
3 " 6"×10"×18'
4 " 6"×10"×13'
7 " 6"×10"×14'
3 " 6"×10"×15'

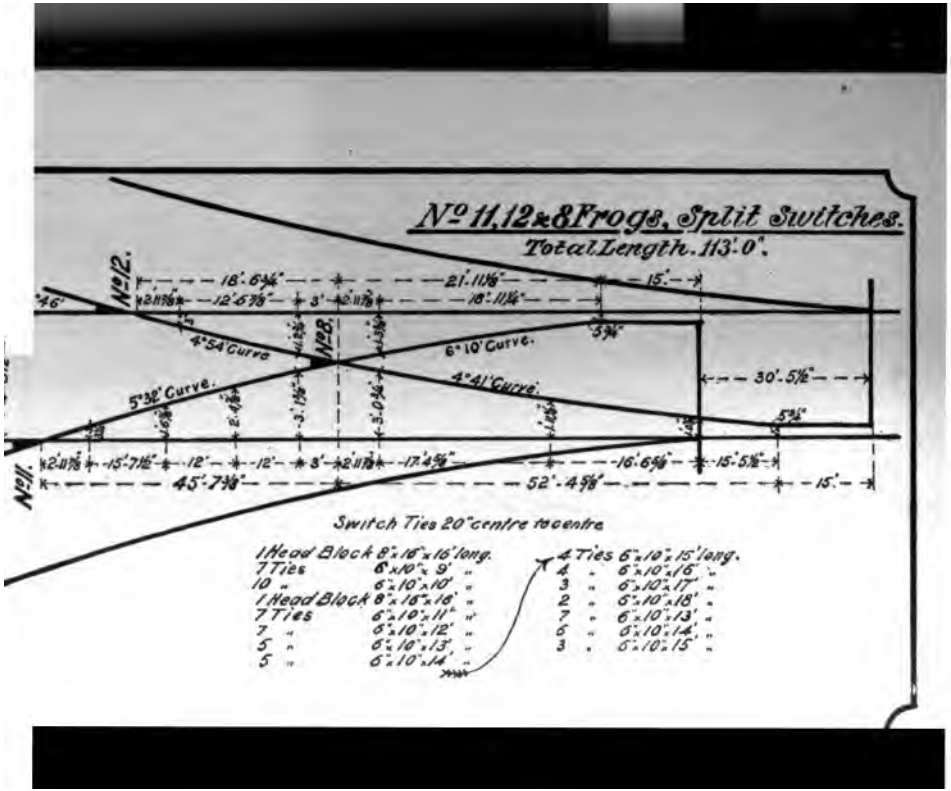
Nº 12, 11 & 8 Frogs, Split Switches.

Total Length. 120.1⅛".



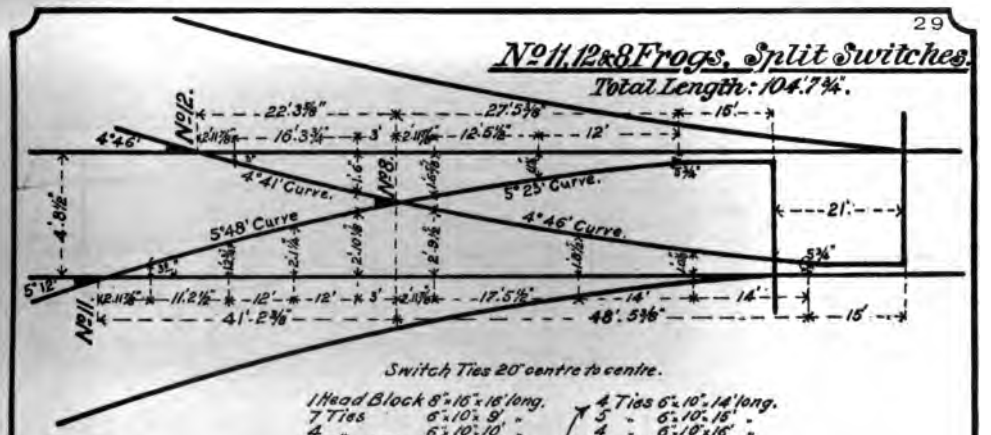

No. 12, 11 & 8, Frogs, Split Switches.
Total Length. 109'.7½"
No 11.
No 8.
No 12.
19'.4⅛"
26'.10"
15'
13'.4¼"
3'.0"
11'.10⅛"
12'
5°12'
6°36' Curve.
4°12' Curve
5°22' Curve
4°.44' Curve.
4°46'
21'
46'.9½"
47'.10"
Switch Ties 20" centre to centre.
1 Head Block 8"x16"x16' long.
7 Ties 6"x10"x9' "
4 " 6"x10"x10' "
1 Head Block 8"x16"x16' "
2 Ties 6"x10"x10' "
8 " 6"x10"x11' "
6 " 6"x10"x12' "
5 " 6"x10"x13' "
5 Ties 6"x10"x14' long.
4 " 6"x10"x15' "
4 " 6"x10"x16' "
4 " 6"x10"x17' "
2 " 6"x10"x18' "
8 " 6"x10"x13' "
6 " 6"x10"x14' "
3 " 6"x10"x15' "


No 12 No 8 Frogs. Split
Total Length: 113'.6
No 10.
14'.2¾"
25'.2¾"
15'
12'.11¾"
8'.2⅞"
3'
19'.3⅜"
8'
7°11' Curve.
No 12
No 8
5°20' Curve
7°24' Curve.
19'.3"
16'
16'
2'
15'.9⅜"
14'
57'.2⅞"


No 11,12 & 8 Frogs, Split Switches.
Total Length. 113'. 0".
No 12.
No 8.
No 11.
4°54' Curve.
5°32' Curve.
6°10' Curve.
4°41' Curve.
45'. 7 7/16"
52'. 4 5/8"
30'. 5 1/2"
Switch Ties 20" centre to centre
1 Head Block 8" x 16" x 16' long.
7 Ties 8" x 10" x 9' "
10 " 6" x 10" x 10' "
1 Head Block 8" x 16" x 16' "
7 Ties 6" x 10" x 11' "
7 " 6" x 10" x 12' "
5 " 6" x 10" x 13' "
5 " 6" x 10" x 14' "
4 Ties 6" x 10" x 15' long.
4 " 6" x 10" x 16' "
3 " 6" x 10" x 17' "
2 " 6" x 10" x 18' "
7 " 6" x 10" x 13' "
6 " 6" x 10" x 14' "
3 " 6" x 10" x 15' "

No 11, 12 & 8 Frogs, Split Switches.

Total Length: 104.7¾".



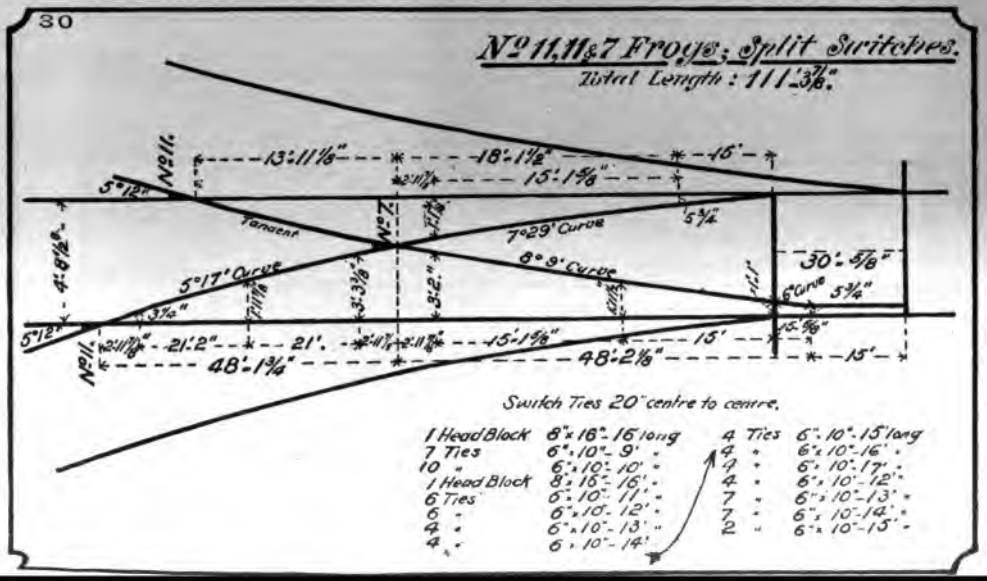
Switch Ties 20" centre to centre.

1 Head Block	8" × 10" × 16' long.	4 Ties	6" × 10" × 14' long.
7 Ties	6" × 10" × 9' "	5 "	6" × 10" × 15' "
4 "	6" × 10" × 10' "	4 "	6" × 10" × 16' "
1 Head Block	8" × 10" × 16' "	4 "	6" × 10" × 17' "
2 Ties	6" × 10" × 10' "	3 "	6" × 10" × 18' "
8 "	6" × 10" × 11' "	2 "	6" × 10" × 13' "
6 "	6" × 10" × 12' "	6 "	6" × 10" × 14' "
6 "	6" × 10" × 13' "	3 "	6" × 10" × 15' "

30

No 11, 11 & 7 Frogs: Split Switches.

Total Length: 111'-3 7/8".

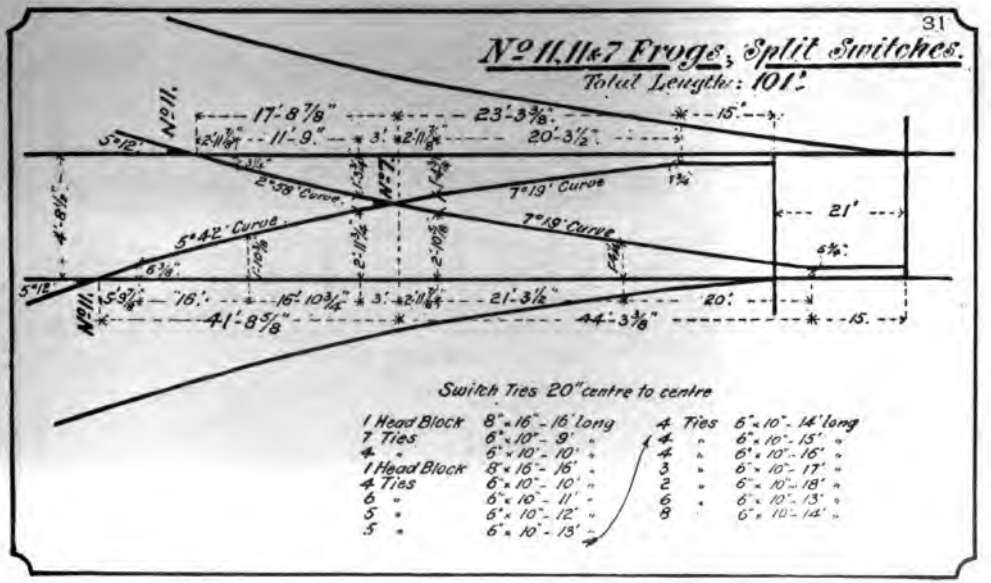


Switch Ties 20" centre to centre.

1 Head Block	8" x 16" - 16' long	4 Ties	6" x 10" - 15' long
7 Ties	6" x 10" - 9' "	9 "	6" x 10" - 16' "
10 "	6" x 10" - 10' "	9 "	6" x 10" - 17' "
1 Head Block	8" x 16" - 16' "	4 "	6" x 10" - 12' "
6 Ties	6" x 10" - 11' "	7 "	6" x 10" - 13' "
6 "	6" x 10" - 12' "	7 "	6" x 10" - 14' "
4 "	6" x 10" - 13' "	2 "	6" x 10" - 15' "
4 "	6" x 10" - 14' "		

No 11, 11 & 7 Frogs, Split Switches.

Total Length: 101'



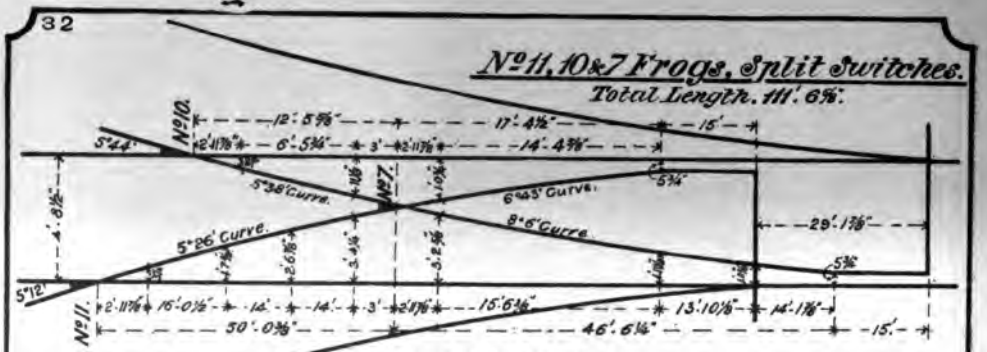
Switch Ties 20" centre to centre

1 Head Block	8" × 16" - 16' long		4 Ties	6" × 10" - 14' long
7 Ties	6" × 10" - 9' "		4 "	6" × 10" - 15' "
4 "	6" × 10" - 10' "		4 "	6" × 10" - 16' "
1 Head Block	8" × 16" - 16' "		3 "	6" × 10" - 17' "
4 Ties	6" × 10" - 10' "		2 "	6" × 10" - 18' "
6 "	6" × 10" - 11' "		6 "	6" × 10" - 13' "
5 "	6" × 10" - 12' "		8 "	6" × 10" - 14' "
5 "	6" × 10" - 13' "			

32

Nº11, 10 & 7 Frogs, Split Switches.

Total Length. 111'. 6⅝".

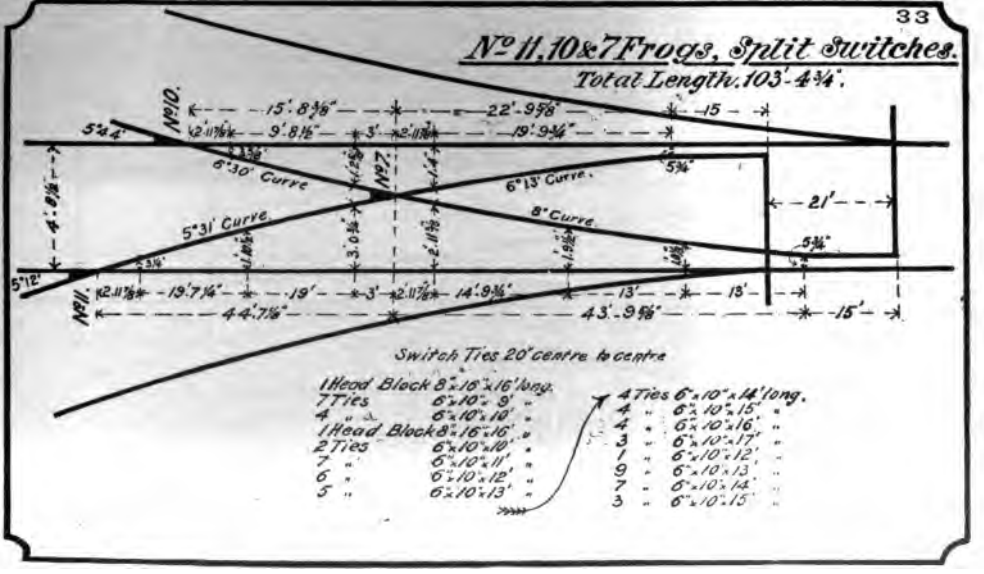


Switch Ties 20" centre to centre.

1 Head Block	8" x 16" x 15' long.	4 Ties	6" x 10" x 15' long.
7 Ties	6" x 10" x 9' "	4 "	6" x 10" x 16' "
9 "	6" x 10" x 10' "	3 "	6" x 10" x 17' "
1 Head Block	8" x 16" x 16' "	6 "	6" x 10" x 12' "
6 Ties	6" x 10" x 11' "	8 "	6" x 10" x 13' "
5 "	6" x 10" x 12' "	5 "	6" x 10" x 14' "
5 "	6" x 10" x 13' "	3 "	6" x 10" x 15' "
4 "	6" x 10" x 14' "		

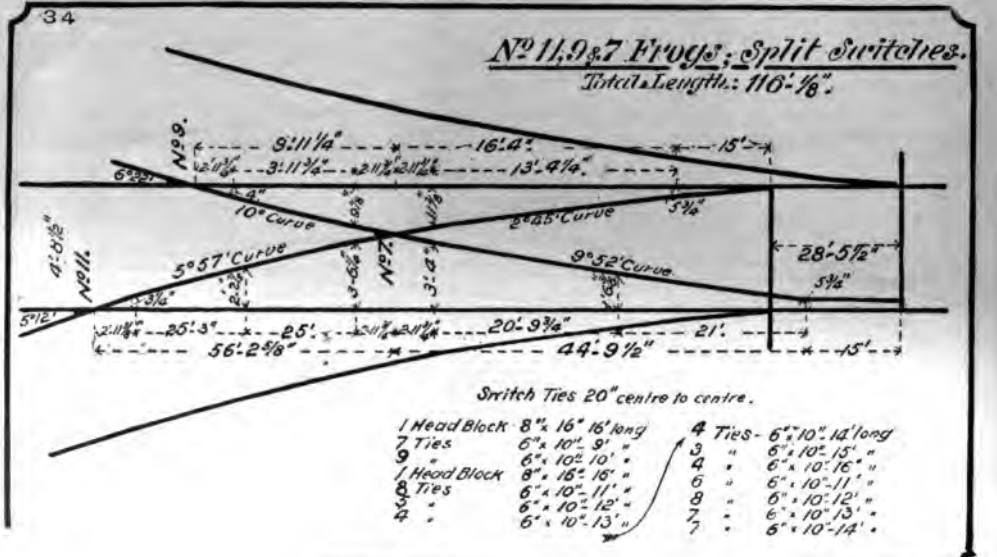
No 11, 10 & 7 Frogs, Split Switches.

Total Length. 103'-4¾".



Nº 11,9 & 7 Frogs; Split Switches.

Total Length: 116'-⅛".

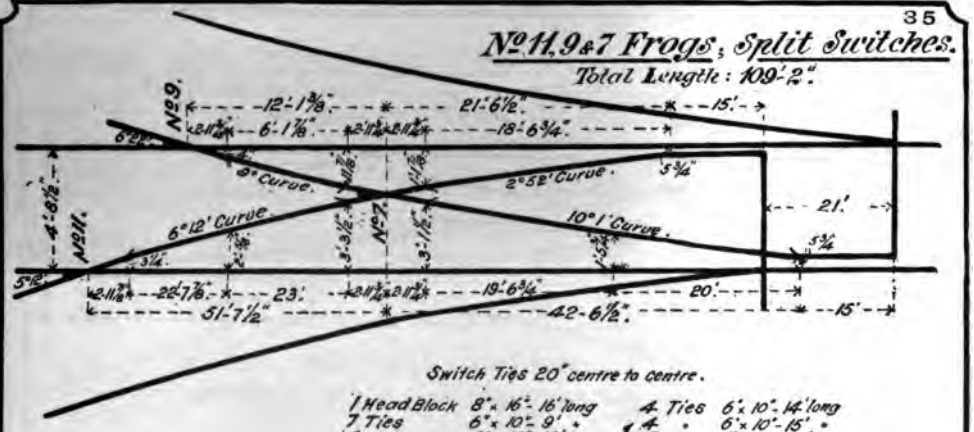


Switch Ties 20" centre to centre.

1 Head Block	8" × 16"	16' long	4 Ties -	6" × 10"	14' long
7 Ties	6" × 10"	9' "	3 "	6" × 10"	15' "
9 "	6" × 10"	10' "	4 "	6" × 10"	16' "
1 Head Block	8" × 16"	16' "	6 "	6" × 10"	11' "
8 Ties	6" × 10"	11' "	8 "	6" × 10"	12' "
5 "	6" × 10"	12' "	7 "	6" × 10"	13' "
4 "	6" × 10"	13' "	7 "	6" × 10"	14' "

No 11, 9 & 7 Frogs; Split Switches.

Total Length: 109'-2".

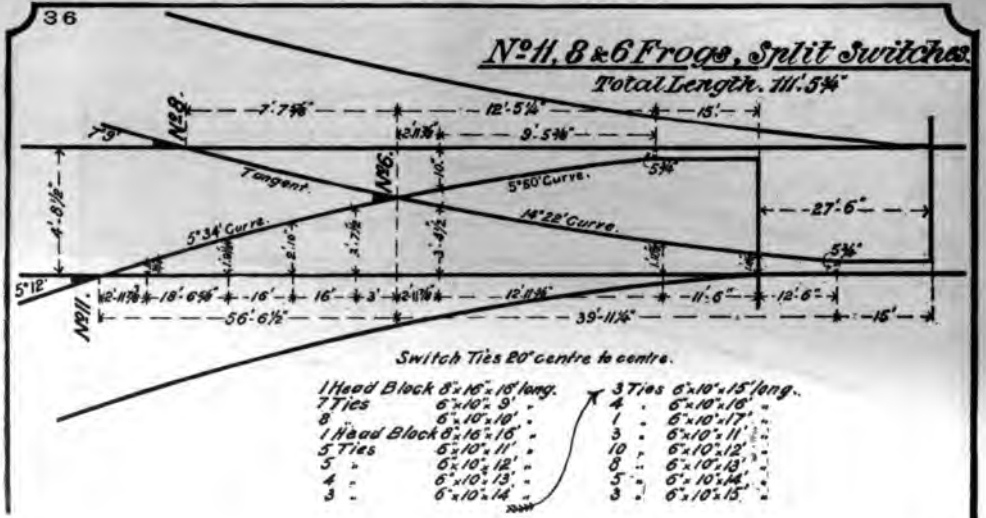


Switch Ties 20" centre to centre.

1 Head Block	8" × 16" - 16' long		4 Ties	6" × 10" - 14' long
7 Ties	6" × 10" - 9' "		4 "	6" × 10" - 15' "
4 "	6" × 10" - 10' "		3 "	6" × 10" - 16' "
1 Head Block	8" × 16" - 16' "		2 "	6" × 10" - 17' "
3 Ties	6" × 10" - 10' "		9 "	6" × 10" - 12' "
7 "	6" × 10" - 11' "		8 "	6" × 10" - 13' "
5 "	6" × 10" - 12' "		6 "	6" × 10" - 14' "
5 "	6" × 10" - 13' "			

No 11, 8 & 6 Frogs, Split Switches.

Total Length. 111'.5¾"

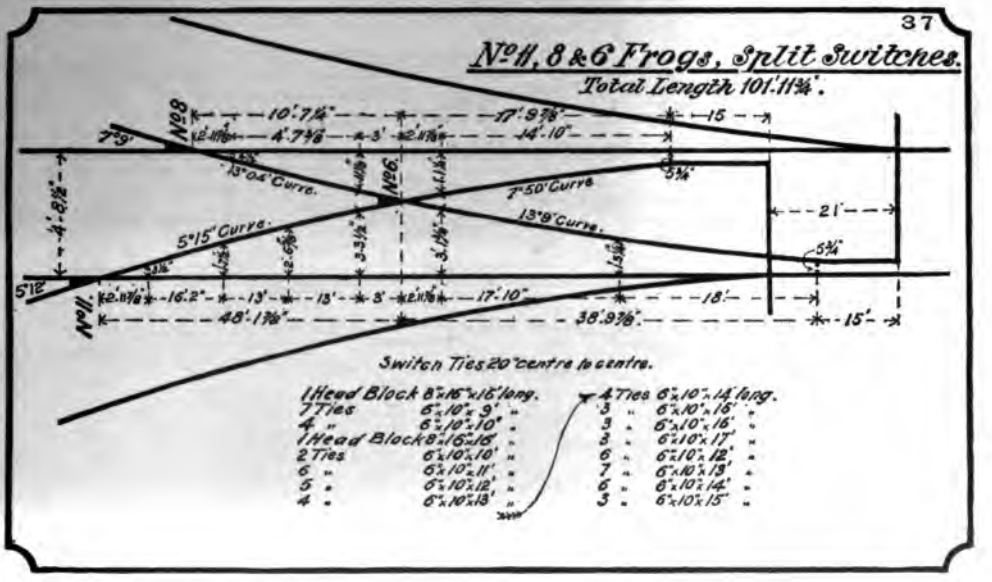


Switch Ties 20" centre to centre.

1 Head Block	8"x16"x18" long.	3 Ties	6"x10"x15" long.
7 Ties	6"x10"x 9" "	4 "	6"x10"x16" "
8 "	6"x10"x10" "	1 "	6"x10"x17" "
1 Head Block	8"x16"x16" "	3 "	6"x10"x11" "
5 Ties	6"x10"x11" "	10 "	6"x10"x12" "
5 "	6"x10"x12" "	8 "	6"x10"x13" "
4 "	6"x10"x13" "	5 "	6"x10"x14" "
3 "	6"x10"x14" "	3 "	6"x10"x15" "

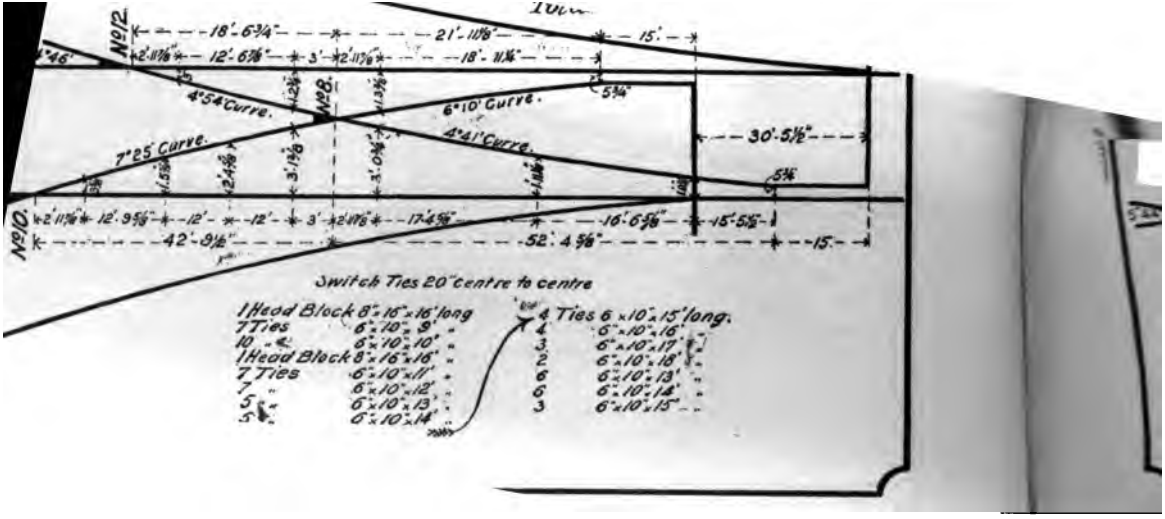
No 11, 8 & 6 Frogs, Split Switches.

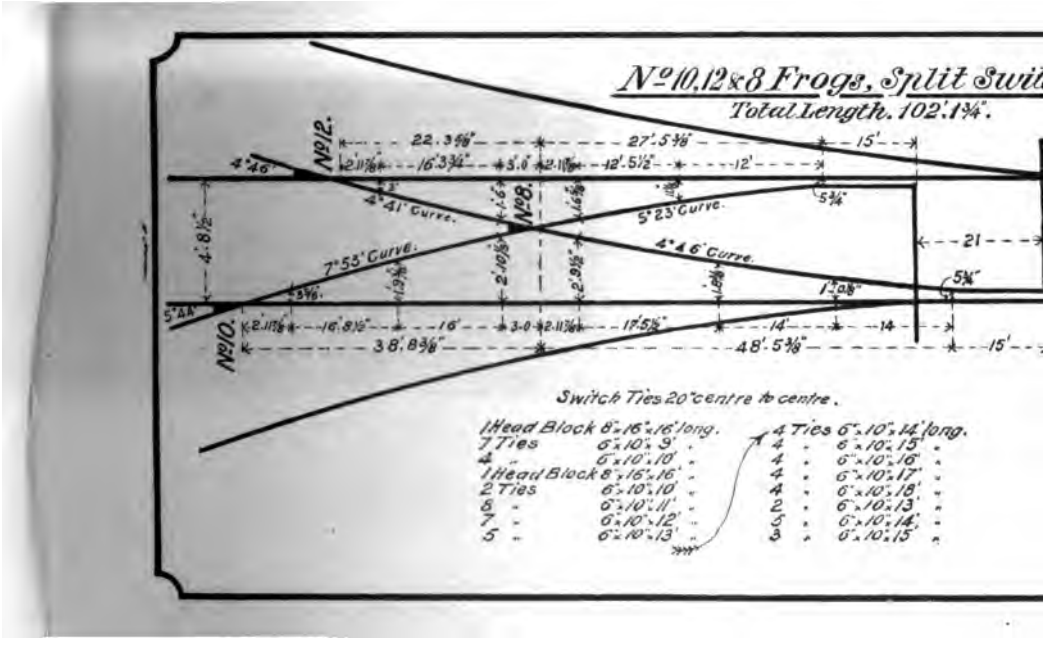
Total Length 101.11¾".



Switch Ties 20" centre to centre.

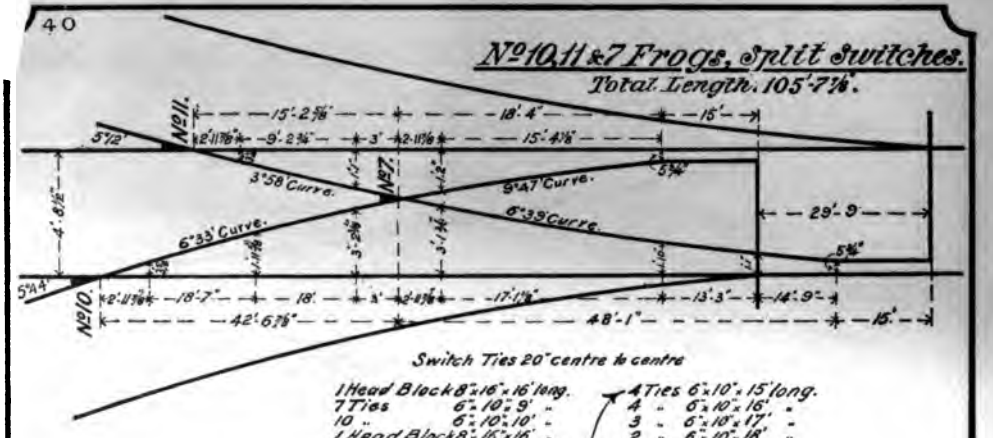
1 Head Block	8"x8"x15' long.	4 Ties	6"x10"x14' long.
7 Ties	6"x10"x 9' "	3 "	6"x10"x15' "
4 "	6"x10"x10' "	3 "	6"x10"x16' "
1 Head Block	8"x8"x15' "	3 "	6"x10"x17' "
2 Ties	6"x10"x10' "	6 "	6"x10"x12' "
6 "	6"x10"x11' "	7 "	6"x10"x13' "
5 "	6"x10"x12' "	6 "	6"x10"x14' "
4 "	6"x10"x13' "	3 "	6"x10"x15' "


No12
No8
No10
18'-6¾"
21'-11⅞"
15'
12'-6⅞"
3'
18'-11¼"
4°54 Curve.
6°10' Curve.
7°25 Curve.
4°41' Curve.
30'-5½"
42'-9½"
52'-4⅝"
16'-6⅝"
15'-5½"
Switch Ties 20" centre to centre
1 Head Block 8"×16"×16' long
7 Ties 6"×10"×9'
10 " 6"×10"×10'
1 Head Block 8"×16"×18'
7 Ties 6"×10"×11'
7 " 6"×10"×12'
5 " 6"×10"×13'
5 " 6"×10"×14'
4 Ties 6"×10"×15' long.
4 6"×10"×16'
3 6"×10"×17'
2 6"×10"×18'
6 6"×10"×13'
6 6"×10"×14'
3 6"×10"×15'


No 10,12 & 8 Frogs, Split Swit
Total Length. 102'.1¾".
No 12.
No 8.
No 10.
22'.3⅝"
27'.5⅜"
15'
16'.3¾"
5'.0"
2'.11⅞"
12'.5½"
12'
4°46'
4°41' Curve.
5°23' Curve.
4°46' Curve.
7°53' Curve.
4'.8½"
5¾"
21
5°44'
3⅜"
1'.9⅜"
2'.10⅝"
2'.9½"
1'.6⅝"
1'.7⅛"
5¾"
2'.11⅞"
16'.8½"
16'
3'.0"
17'.5½"
14'
14
38'.8⅜"
48'.5⅜"
15'
Switch Ties 20" centre to centre.
1 Head Block 8"×16"×16' long.
7 Ties 6"×10"×9' "
4 " 6"×10"×10' "
1 Head Block 8"×16"×16' "
2 Ties 6"×10"×10' "
5 " 6"×10"×11' "
7 " 6"×10"×12' "
5 " 6"×10"×13' "
4 Ties 6"×10"×14' long.
4 " 6"×10"×15' "
4 " 6"×10"×16' "
4 " 6"×10"×17' "
4 " 6"×10"×18' "
2 " 6"×10"×13' "
5 " 6"×10"×14' "
3 " 6"×10"×15' "

No 10, 11 & 7 Frogs, Split Switches.

Total Length. 105'-7⅛".

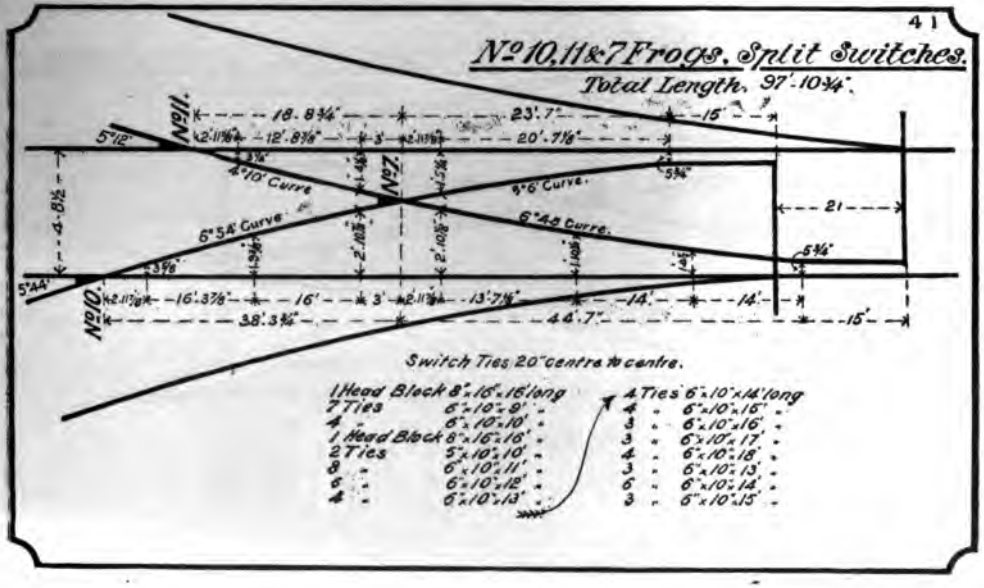


Switch Ties 20" centre to centre

1 Head Block	8"×16"×16' long.	4 Ties	6"×10"×15' long.
7 Ties	6"×10"×9' "	4 "	6"×10"×16' "
10 "	6"×10"×10' "	3 "	6"×10"×17' "
1 Head Block	8"×16"×16' "	2 "	6"×10"×18' "
6 Ties	6"×10"×11' "	7 "	6"×10"×13' "
6 "	6"×10"×12' "	6 "	6"×10"×14' "
5 "	6"×10"×13' "	3 "	6"×10"×15' "
3 "	6"×10"×14' "		

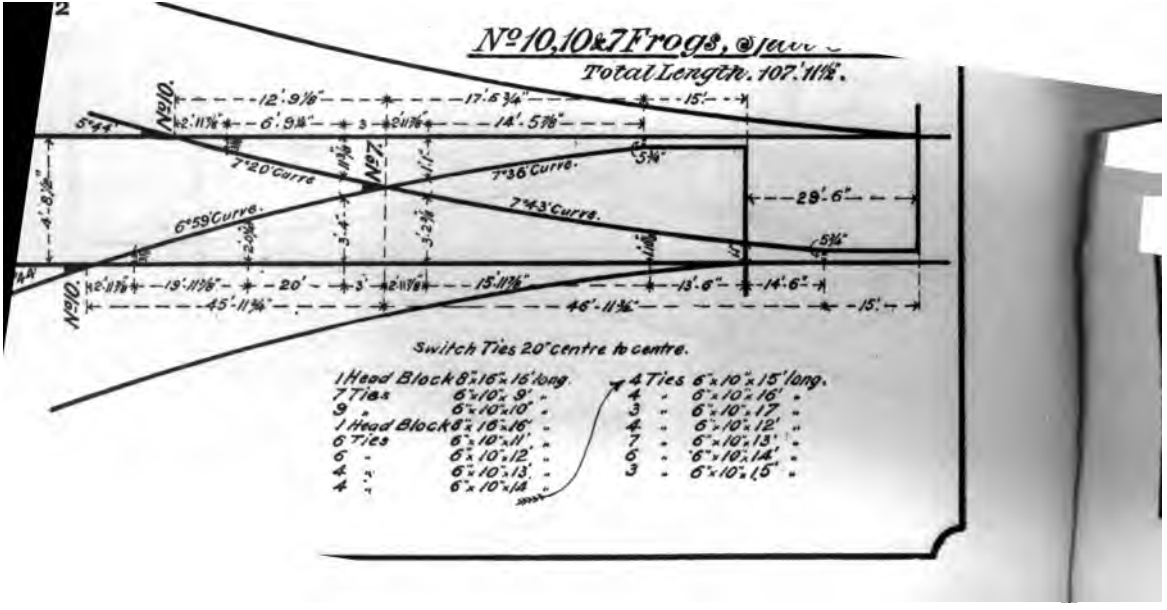
No. 10, 11 & 7 Frogs. Split Switches.

Total Length. 97'-10¾".

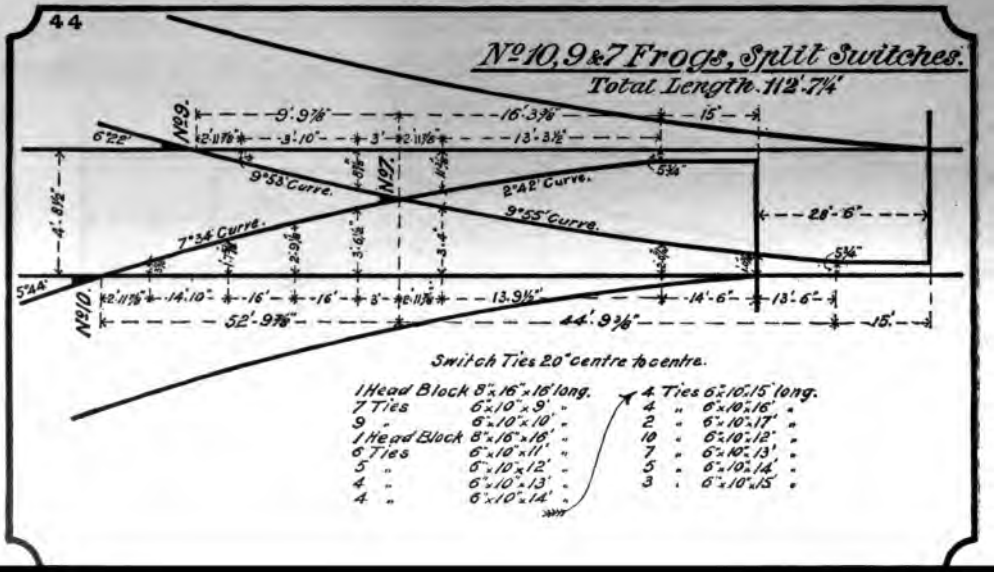


Switch Ties 20" centre to centre.

1 Head Block	8"×16"×16' long	4 Ties	6"×10"×14' long
7 Ties	6"×10"×9' "	4 "	6"×10"×15' "
4 "	6"×10"×10' "	3 "	6"×10"×16' "
1 Head Block	8"×16"×16' "	3 "	6"×10"×17' "
2 Ties	5"×10"×10' "	4 "	6"×10"×18' "
8 "	6"×10"×11' "	3 "	6"×10"×13' "
6 "	6"×10"×12' "	6 "	6"×10"×14' "
4 "	6"×10"×13' "	3 "	6"×10"×15' "

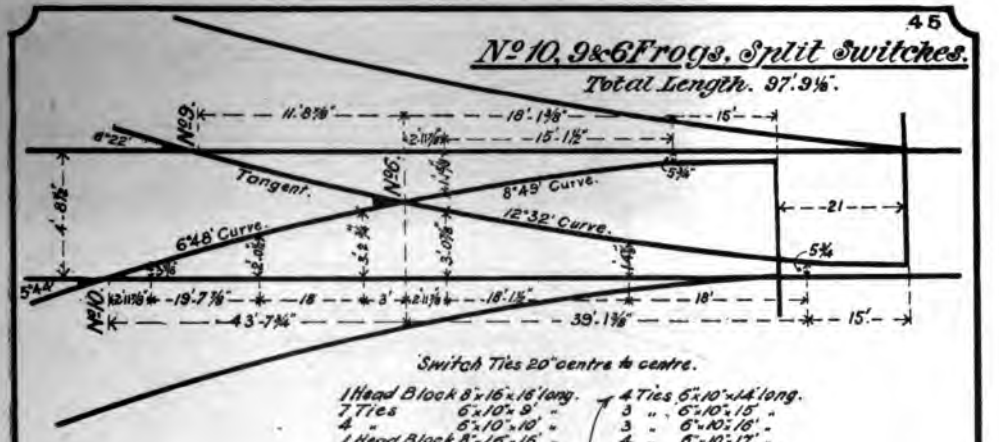

2
No 10, 10 & 7 Frogs, Jaw
Total Length. 107'. 11½".
No 10.
No 7.
12'. 9⅛"
17'. 5¾"
15'.
5'. 4"
2'. 11⅞"
6'. 9⅛"
3
2'. 11⅞"
14'. 5⅞"
7° 20' Curve
7° 36' Curve.
7° 43' Curve.
6° 59' Curve.
5¾"
29'. 6"
4'. 8½"
2'. 11⅞"
3'. 4"
3'. 2¾"
1'. 11"
5¾"
19'. 11⅞"
20'
3'
2'. 11⅞"
15'. 11⅞"
13'. 6"
14'. 6"
45'. 11¾"
46'. 11¾"
15'.
Switch Ties 20" centre to centre.
1 Head Block 8" x 16" x 16' long.
7 Ties 6" x 10" x 9' "
9 " 6" x 10" x 10' "
1 Head Block 8" x 16" x 16' "
6 Ties 6" x 10" x 11' "
6 " 6" x 10" x 12' "
4 " 6" x 10" x 13' "
4 " 6" x 10" x 14' "
4 Ties 6" x 10" x 15' long.
4 " 6" x 10" x 16' "
3 " 6" x 10" x 17' "
4 " 6" x 10" x 12' "
7 " 6" x 10" x 13' "
6 " 6" x 10" x 14' "
3 " 6" x 10" x 15' "

No10.
16'.2 5/8"
5°44'
6°59' Curve.
No7.
7°20' Curve.
4'.0 1/2"
5°44'
No10.
40'.11 3/8"
1 Head Block
7 Ties
4 "
1 Head Block
2 Ties
7 "
6 "
4 "


No 10, 9 & 7 Frogs, Split Switches.
Total Length. 112'-7¼'
No 9.
No 7.
No 10.
9'-9⅞"
16'-3⅞"
15'-
2'-11⅞"
3'-10"
3'
2'-11⅞"
13'-3½"
6°22'
9°53' Curve.
2°42' Curve.
9°55' Curve.
7°34' Curve.
4'-8½"
5°44'
28'-6"
5¾"
2'-11⅞"
14'-10"
16'
16'
3'
2'-11⅞"
13.9½"
14'-6"
13'-6"
52'-9⅞"
44'-9⅞"
15'
Switch Ties 20" centre to centre.
1 Head Block 8"x16"x16' long.
7 Ties 6"x10"x9' "
9 " 6"x10"x10' "
1 Head Block 8"x16"x16' "
6 Ties 6"x10"x11' "
5 " 6"x10"x12' "
4 " 6"x10"x13' "
4 " 6"x10"x14' "
4 Ties 6"x10"x15' long.
4 " 6"x10"x16' "
2 " 6"x10"x17' "
10 " 6"x10"x12' "
7 " 6"x10"x13' "
5 " 6"x10"x14' "
3 " 6"x10"x15' "

Nº 10, 9 & 6 Frogs, Split Switches.

Total Length. 97'.3⅛".

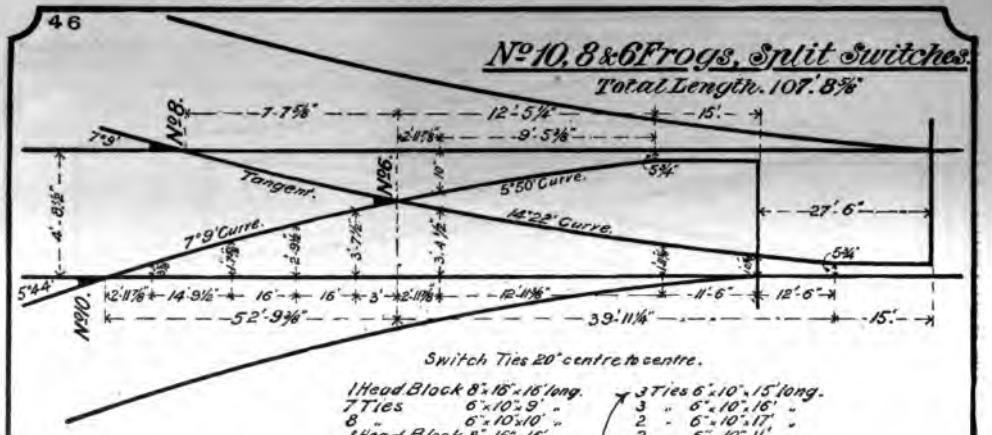


Switch Ties 20" centre to centre.

1 Head Block	8"×16"×16' long.	4 Ties	6"×10"×14' long.
7 Ties	6"×10"×9' "	3 "	6"×10"×15' "
4 "	6"×10"×10' "	3 "	6"×10"×16' "
1 Head Block	8"×16"×16' "	4 "	6"×10"×17' "
2 Ties	6"×10"×10' "	3 "	6"×10"×12' "
6 "	6"×10"×11' "	7 "	6"×10"×13' "
5 "	6"×10"×12' "	6 "	6"×10"×14' "
4 "	6"×10"×13' "	3 "	6"×10"×15' "

No. 10, 8 & 6 Frogs, Split Switches.

Total Length. 107'. 8⅝"

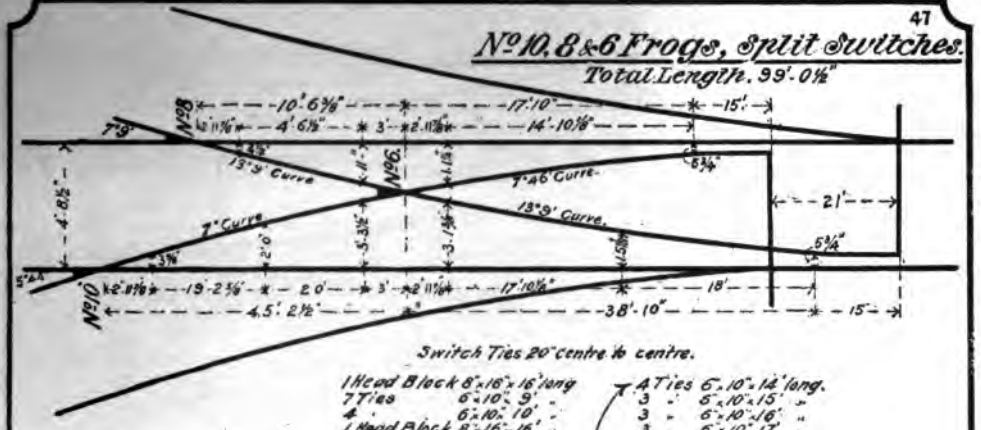


Switch Ties 20" centre to centre.

1 Head Block	8" × 16" × 16' long.	3 Ties	6" × 10" × 15' long.
7 Ties	6" × 10" × 9' "	3 "	6" × 10" × 16' "
8 "	6" × 10" × 10' "	2 "	6" × 10" × 17' "
1 Head Block	8" × 16" × 16' "	2 "	6" × 10" × 11' "
4 Ties	6" × 10" × 11' "	8 "	6" × 10" × 12' "
5 "	6" × 10" × 12' "	8 "	6" × 10" × 13' "
4 "	6" × 10" × 13' "	5 "	6" × 10" × 14' "
4 "	6" × 10" × 14' "	4 "	6" × 10" × 15' "

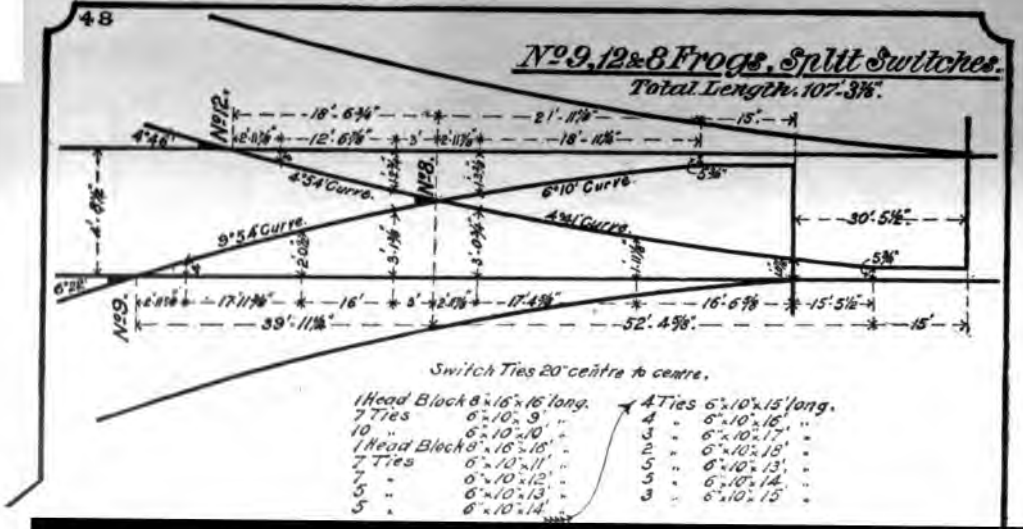
No. 10, 8 & 6 Frogs, Split Switches.

Total Length. 99'-0½"



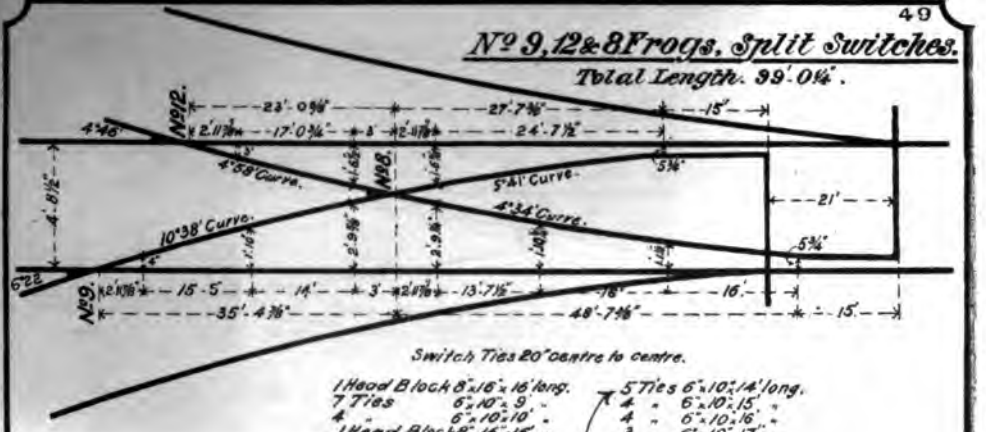
Switch Ties 20" centre to centre.

1 Head Block	8"×16"×16' long	4 Ties	6"×10"×14' long.
7 Ties	6"×10"×9' "	3 "	6"×10"×15' "
4 "	6"×10"×10' "	3 "	6"×10"×16' "
1 Head Block	8"×16"×16' "	3 "	6"×10"×17' "
2 Ties	6"×10"×10' "	6 "	6"×10"×12' "
5 "	6"×10"×11' "	6 "	6"×10"×13' "
5 "	6"×10"×12' "	6 "	6"×10"×14' "
4 "	6"×10"×13' "	3 "	6"×10"×15' "


No 9, 12 & 8 Frogs, Split Switches.
Total Length. 107'-3⅛".
No 12.
No 8.
No 9.
18'-6¾"
21'-11⅛"
15'-
4°-46'
2'-11⅛"
12'-6⅛"
3'
2'-11⅞"
18'-11⅝"
4°54' Curve.
6°10' Curve.
9°54' Curve.
4°36' Curve.
3°-5¾"
30'-5½"
5⅜"
6°-22'
4'-6⅛"
2'-11⅛"
17'-11⅜"
16'
3'
2'-11⅞"
17'-4⅝"
16'-6⅝"
15'-5½"
39'-11⅛"
52'-4⅝"
15'
Switch Ties 20" centre to centre.
1 Head Block 8"×16"×16' long.
7 Ties 6"×10"×9' "
10 " 6"×10"×10' "
1 Head Block 8"×16"×16' "
7 Ties 6"×10"×11' "
7 " 6"×10"×12' "
5 " 6"×10"×13' "
5 " 6"×10"×14' "
4 Ties 6"×10"×15' long.
4 " 6"×10"×16' "
3 " 6"×10"×17' "
2 " 6"×10"×18' "
5 " 6"×10"×13' "
5 " 6"×10"×14' "
3 " 6"×10"×15' "

Nº 9, 12 & 8 Frogs, Split Switches.

Total Length. 99'-0¼".

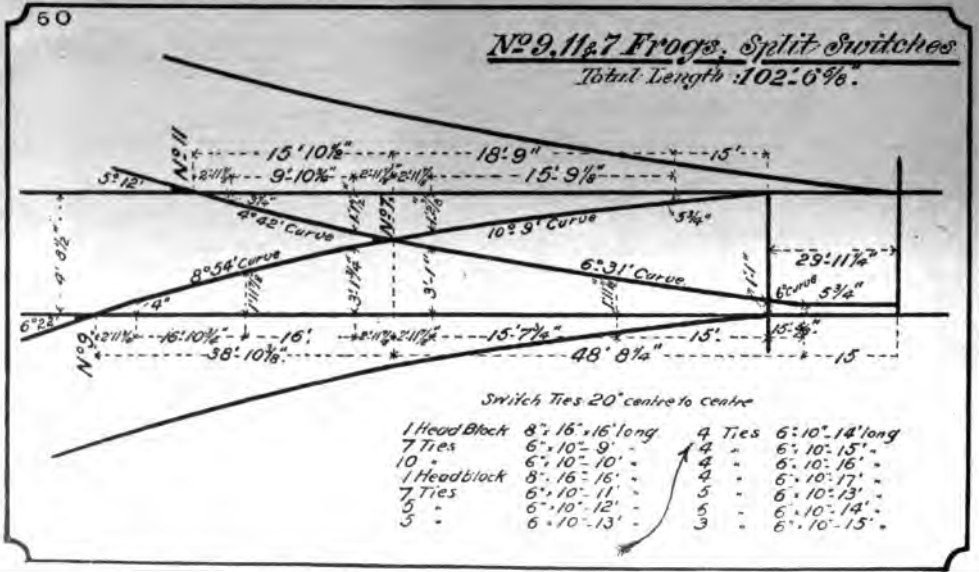


Switch Ties 20" centre to centre.

1 Head Block	8"x16"x16' long.		5 Ties	6"x10"x14' long.	
7 Ties	6"x10"x9'	"	4 "	6"x10"x15'	"
4 "	6"x10"x10'	"	4 "	6"x10"x16'	"
1 Head Block	8"x16"x16'	"	3 "	6"x10"x17'	"
2 Ties	6"x10"x10'	"	3 "	6"x10"x18'	"
8 "	6"x10"x11'	"	2 "	6"x10"x19'	"
6 "	6"x10"x12'	"	5 "	6"x10"x14'	"
6 "	6"x10"x13'	"	3 "	6"x10"x15'	"

No 9, 11 & 7 Frogs, Split Switches

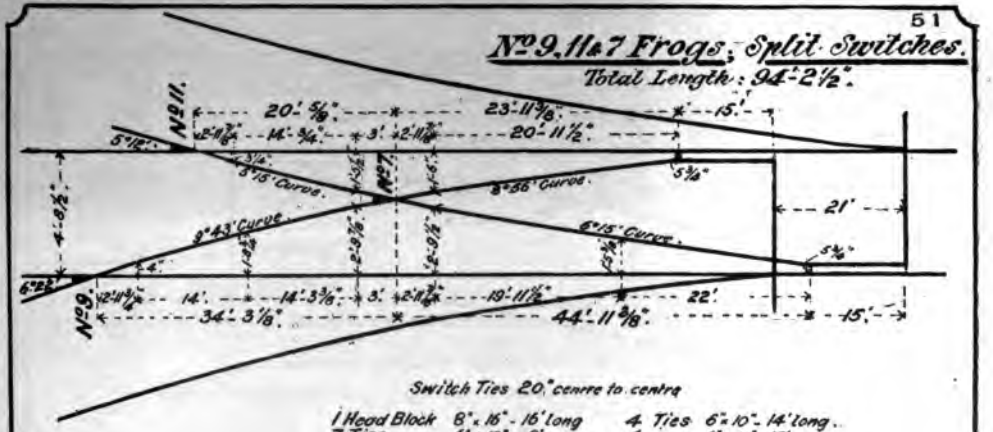
Total Length 102'-6⅝".



1 Head Block	8" × 16" × 16' long		4 Ties	6" × 10" × 14' long
7 Ties	6" × 10" – 9' "		4 "	6" × 10" – 15' "
10 "	6" × 10" – 10' "		4 "	6" × 10" – 16' "
1 Head block	8" × 16" – 16' "		4 "	6" × 10" – 17' "
7 Ties	6" × 10" – 11' "		5 "	6" × 10" – 13' "
5 "	6" × 10" – 12' "		6 "	6" × 10" – 14' "
5 "	6" × 10" – 13' "		3 "	6" × 10" – 15' "

No. 9, 11 & 7 Frogs; Split Switches.

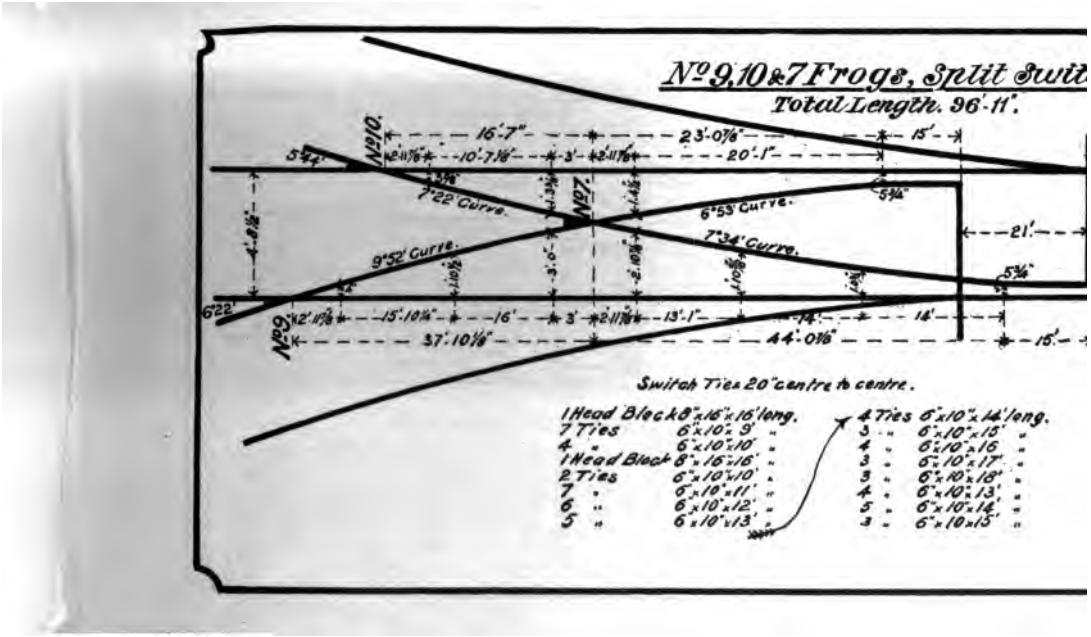
Total Length: 94'-2½".

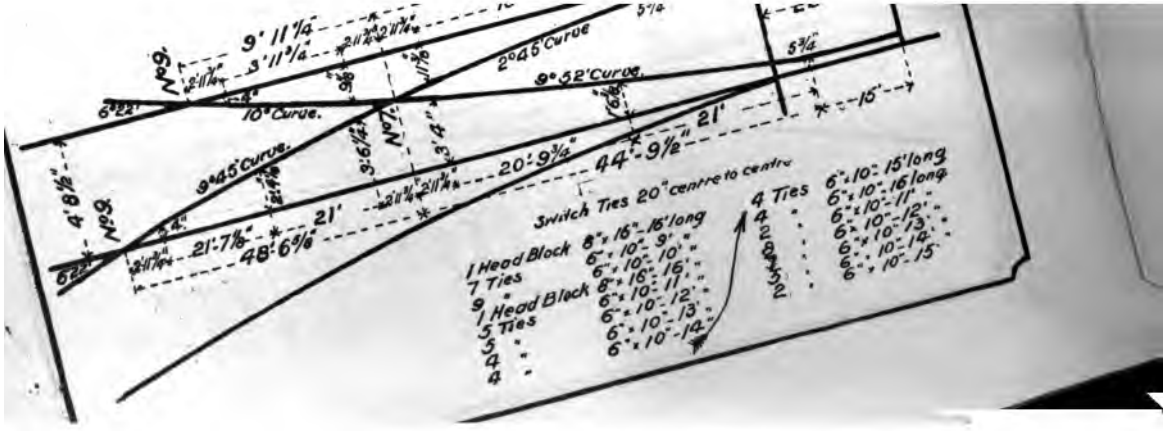


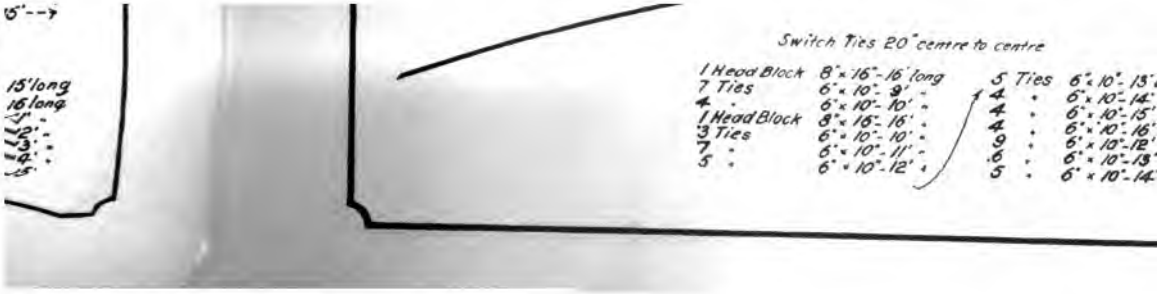
Switch Ties 20" centre to centre

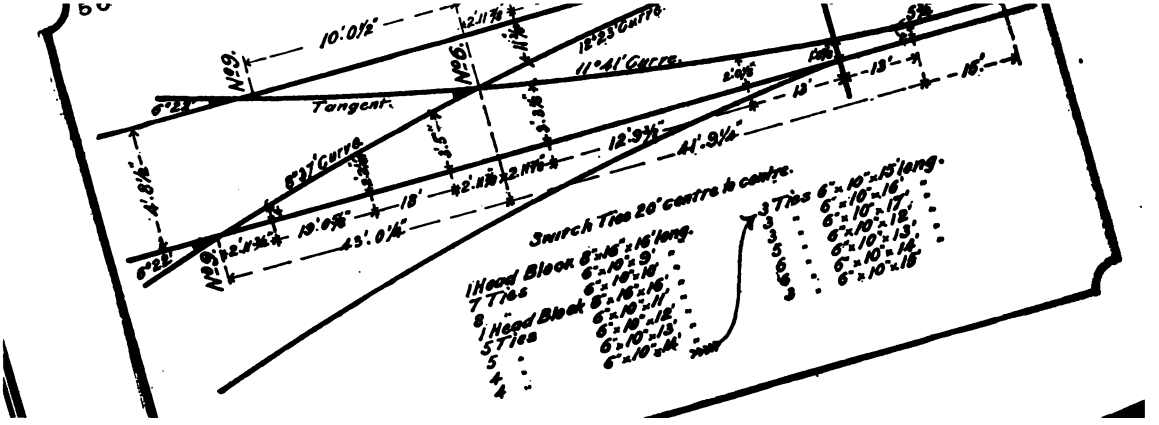
1 Head Block	8" × 16" - 16' long	4 Ties	6" × 10" - 14' long.
7 Ties	6" × 10" - 9' "	4 "	6" × 10" - 15' "
4 "	6" × 10" - 10' "	4 "	6" × 10" - 16' "
1 Head Block	8" × 16" - 16' "	3 "	6" × 10" - 17' "
4 Ties	6" × 10" - 10' "	4 "	6" × 10" - 18' "
6 "	6" × 10" - 11' "	2 "	6" × 10" - 13' "
5 "	6" × 10" - 12' "	6	6" × 10" - 14' "
5 "	6" × 10" - 13' "		

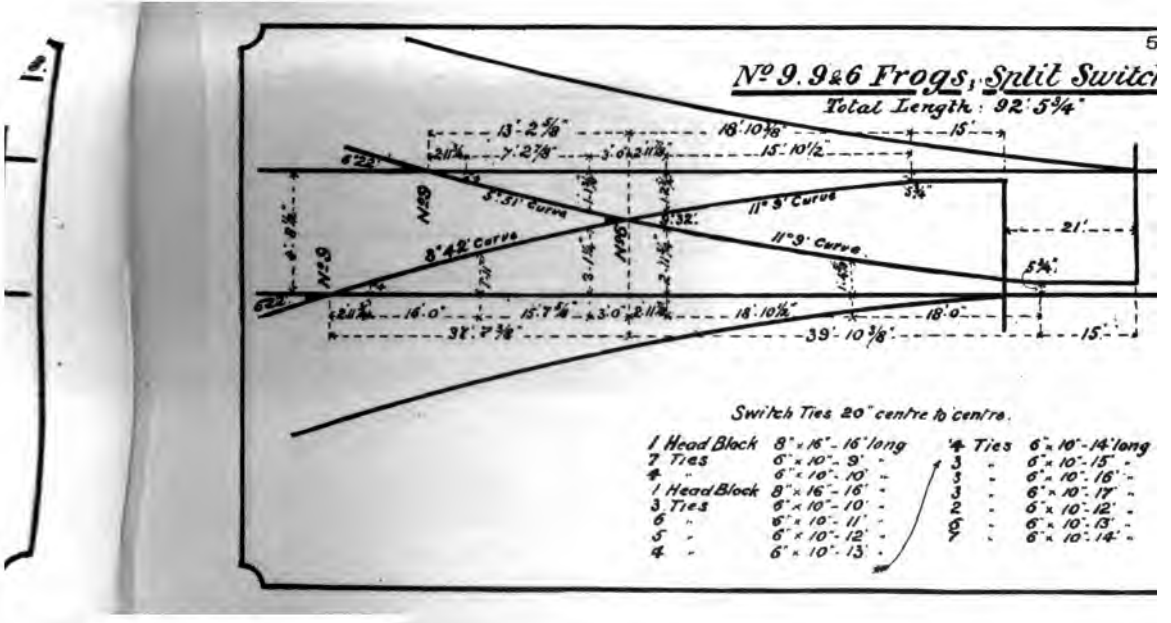
4'-6½"
9"17' Curve
18'-10⅝"
42'-10½"
6"-2.2"
N.E.
Switch Ties 20" centre to centre.
1 Head Block 8"×16"×16 long.
7 Ties 6"×10"×9'
9 " 6"×10"×10'
1 Head Block 8"×16"×16'
5 Ties 6"×10"×11'
6 " 6"×10"×12'
5 " 6"×10"×13'
4 " 6"×10"×14'
4 Ties 6"×10"×15' long
4 " 6"×10"×16'
3 " 6"×10"×17'
6 " 6"×10"×12'
5 " 6"×10"×13'
6"×10"×14'
6"×10"×15'

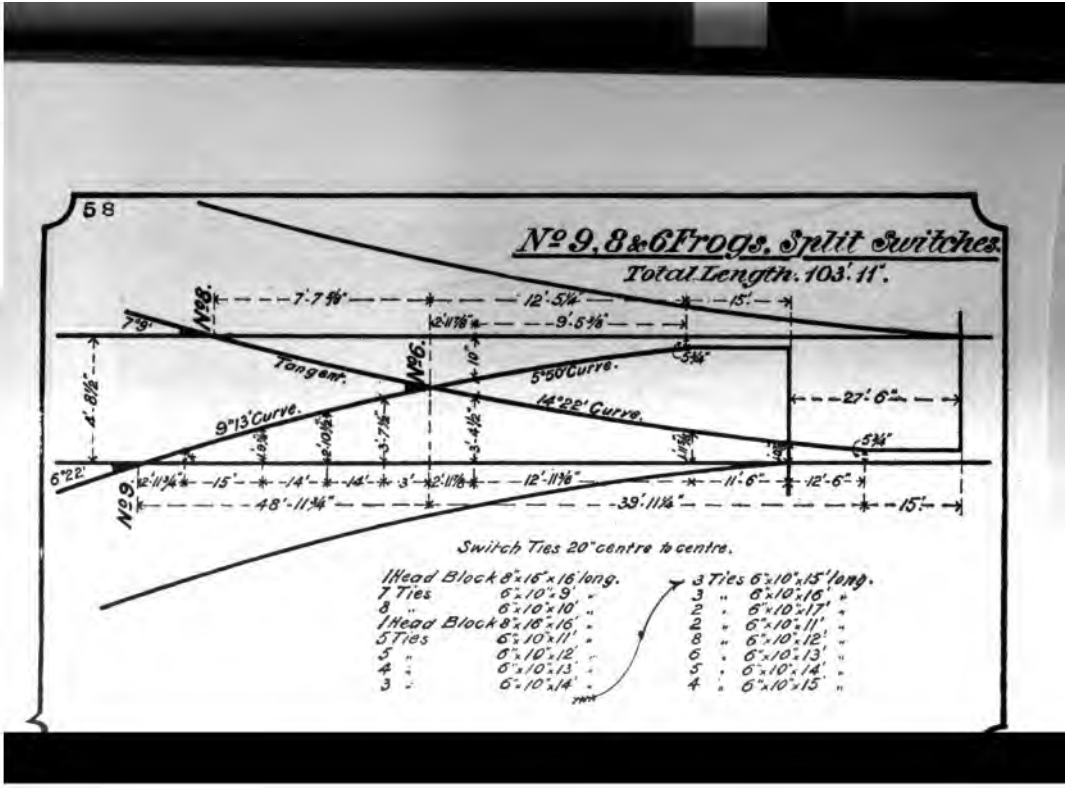

No 9, 10 & 7 Frogs, Split Swit
Total Length. 96'-11".
No 10.
No 7.
No 9.
16'-7"
23'-0⅞"
15'
5¾"
2-11⅞"
10'-7⅛"
3'
2-11⅞"
20'-1"
7°22' Curve.
6°53' Curve.
5¾"
21'
9°52' Curve.
7°34' Curve.
4'-1⅛"
6'22"
5¾"
2-11⅞"
15'-10⅛"
16'
3'
2-11⅞"
13'-1"
14'
18'
37'-10⅛"
44'-0⅛"
15'
Switch Ties 20" centre to centre.
1 Head Block 8"x16"x16" long.
7 Ties 6"x10"x 9" "
4 " 6"x10"x10" "
1 Head Block 8"x16"x16" "
2 Ties 6"x10"x10" "
7 " 6"x10"x11" "
6 " 6"x10"x12" "
5 " 6"x10"x13" "
4 Ties 6"x10"x14' long.
3 " 6"x10"x15" "
4 " 6"x10"x16" "
3 " 6"x10"x17" "
3 " 6"x10"x18" "
4 " 6"x10"x13" "
5 " 6"x10"x14" "
3 " 6"x10"x15" "


9° 11¼"
3° 11¼"
2° 45' Curve
9° 32' Curve
10° Curve.
9° 45' Curve.
No 9.
No 7.
No 5.
4' 8½"
21'
21' 7⅞"
48' 6⅝"
20' 9¾"
44' 9½"
15'
Switch Ties 20" centre to centre
1 Head Block 8" x 16" - 16' long
7 Ties 6" x 10" - 9' "
9 " 6" x 10" - 10' "
1 Head Block 8" x 16" - 16' "
5 Ties 6" x 10" - 11' "
5 " 6" x 10" - 12' "
4 " 6" x 10" - 13' "
4 " 6" x 10" - 14' "
4 Ties 6" x 10" - 15' long
4 " 6" x 10" - 16' long
6" x 10" - 11' "
6" x 10" - 12' "
6" x 10" - 13' "
6" x 10" - 14' "
6" x 10" - 15'


6"-->
15'long
16'long
Switch Ties 20" centre to centre
1 Head Block 8" x 16" - 16' long
7 Ties 6" x 10" - 9' "
4 " 6" x 10" - 10' "
1 Head Block 8" x 16" - 16' "
3 Ties 6" x 10" - 10' "
7 " 6" x 10" - 11' "
5 " 6" x 10" - 12' "
5 Ties 6" x 10" - 13'
4 " 6" x 10" - 14'
4 " 6" x 10" - 15'
4 " 6" x 10" - 16'
9 " 6" x 10" - 12'
6 " 6" x 10" - 13'
5 " 6" x 10" - 14'

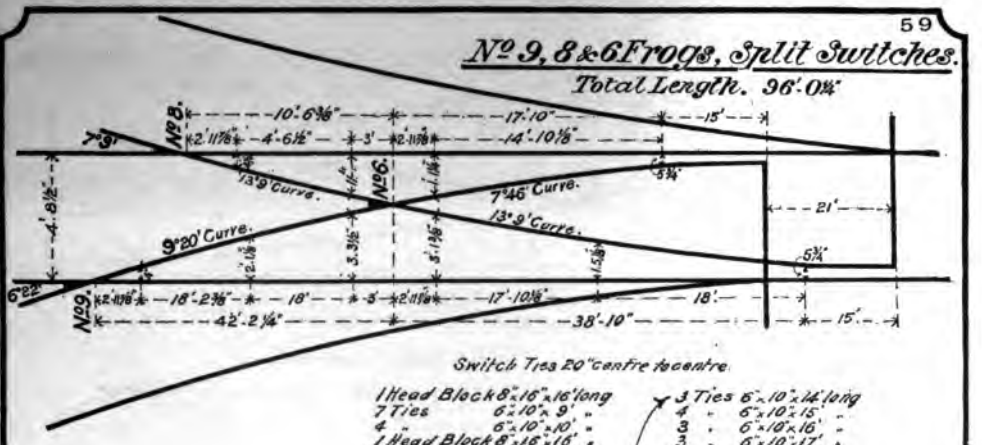

No 9.
10'.0½"
No 6.
12°23' Curve
11°41' Curve
Tangent.
6°27' Curve
6°22'
41'.9¼"
12'.9½"
19'.0⅝"
18'
45'.0¼"
Snirch Ties 20' centre to centre.
1 Head Block 6"×6"×15" long.
7 Ties 6"×10"×9" "
8 " 6"×10"×10" "
1 Head Block 6"×6"×15" "
5 Ties 6"×10"×11" "
5 " 6"×10"×12" "
4 " 6"×10"×13" "
6"×10"×14" "
3 Ties 6"×10"×15" long.
3 " 6"×10"×16" "
3 " 6"×10"×17" "
5 " 6"×10"×12" "
6 " 6"×10"×13" "
6 " 6"×10"×14" "
3 " 6"×10"×16" "


No 9. 9&6 Frogs, Split Switch
Total Length: 92' 5¾"
13' 2⅝"
18' 10⅜"
15'
15' 10½"
6°22'
2' 2⅞"
3' 6½"
11° 3' Curve
5° 31' Curve
8° 42½' Curve
No 9
No 9
5° 32'
11° 9' Curve
21'
5¾"
16' 0"
15' 7⅝"
3' 0"
18' 10⅜"
18' 0"
39' 7⅜"
39' 10⅜"
15'
Switch Ties 20" centre to centre.
1 Head Block 8" x 16" - 16' long
7 Ties 6" x 10" - 9' "
4 " 6" x 10" - 10' "
1 Head Block 8" x 16" - 16' "
3 Ties 6" x 10" - 10' "
6 " 6" x 10" - 11' "
5 " 6" x 10" - 12' "
4 " 6" x 10" - 13' "
4 Ties 6" x 10" - 14' long
3 " 6" x 10" - 15' "
3 " 6" x 10" - 16' "
3 " 6" x 10" - 17' "
2 " 6" x 10" - 12' "
6 " 6" x 10" - 13' "
7 " 6" x 10" - 14' "


58
No 9, 8 & 6 Frogs, Split Switches.
Total Length. 103'. 11".
No 8.
No 6.
No 9.
Tangent.
9°13' Curve.
5°50' Curve.
14°22' Curve.
6°22'
7'-7 5/8"
12'-5 1/4"
15'-
9'-5 5/8"
27'-6"
4'-8 1/2"
48'-11 3/4"
39'-11 1/4"
Switch Ties 20" centre to centre.
1 Head Block 8"x16"x16' long.
7 Ties 6"x10"x9' "
8 " 6"x10"x10' "
1 Head Block 8"x16"x16' "
5 Ties 6"x10"x11' "
5 " 6"x10"x12' "
4 " 6"x10"x13' "
3 " 6"x10"x14' "
3 Ties 6"x10"x15' long.
3 " 6"x10"x16' "
2 " 6"x10"x17' "
2 " 6"x10"x11' "
8 " 6"x10"x12' "
6 " 6"x10"x13' "
5 " 6"x10"x14' "
4 " 6"x10"x15' "

No 9, 8 & 6 Frogs, Split Switches.

Total Length. 36'-0¼"

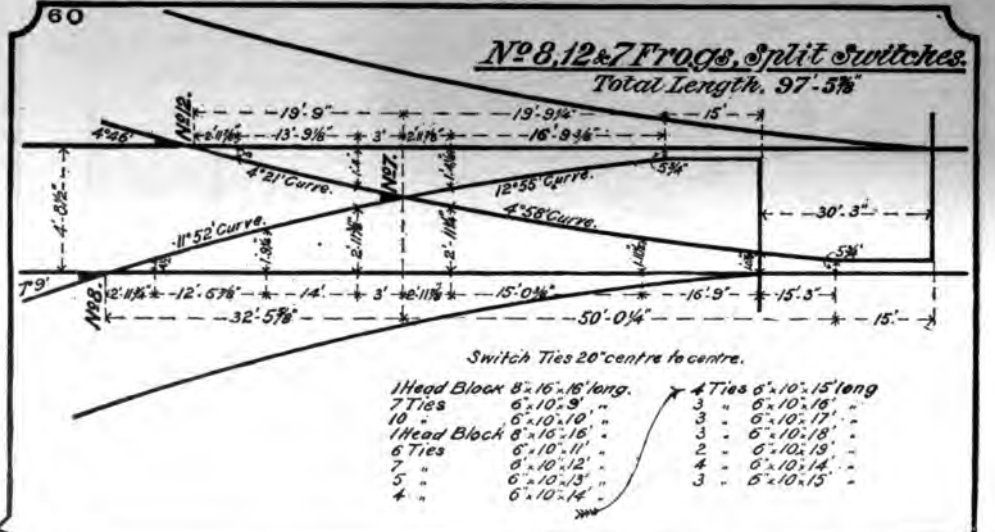


Switch Ties 20" centre to centre

1 Head Block	8"×16"×16' long	3 Ties	6"×10"×14' long
7 Ties	6"×10"×9' "	4 "	6"×10"×15' "
4 "	6"×10"×10' "	3 "	6"×10"×16' "
1 Head Block	8"×16"×16' "	3 "	6"×10"×17' "
2 Ties	6"×10"×10' "	4 "	6"×10"×12' "
6 "	6"×10"×11' "	6 "	6"×10"×13' "
5 "	6"×10"×12' "	3 "	6"×10"×14' "
4 "	6"×10"×13' "	4 "	6"×10"×15' "

No 8, 12 & 7 Frogs, Split Switches.

Total Length. 97'-5⅞"

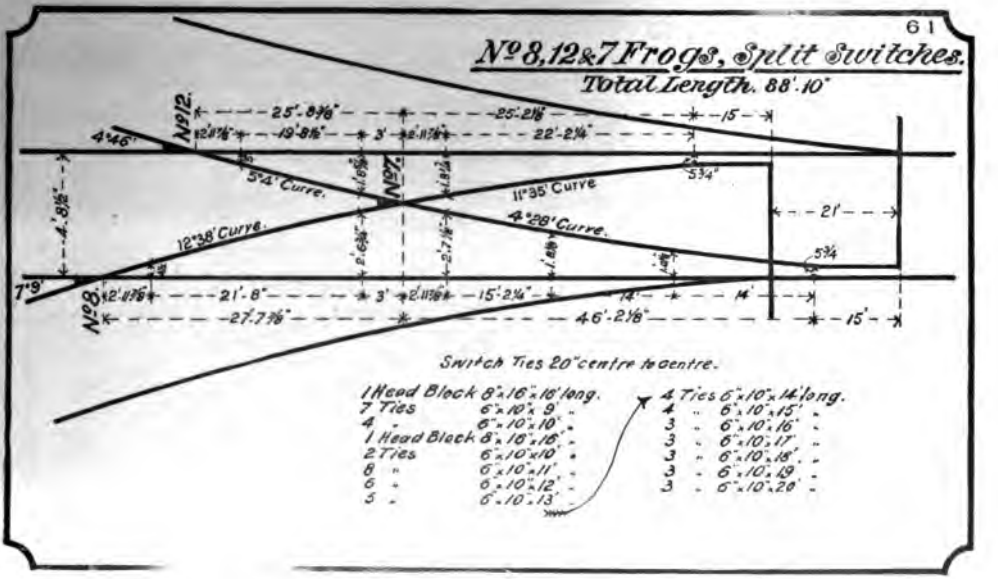


Switch Ties 20" centre to centre.

1 Head Block	8"×16"×16' long.	4 Ties	6"×10"×15' long
7 Ties	6"×10"×9' "	3 "	6"×10"×16' "
10 "	6"×10"×10' "	3 "	6"×10"×17' "
1 Head Block	8"×16"×16' "	3 "	6"×10"×18' "
6 Ties	6"×10"×11' "	2 "	6"×10"×19' "
7 "	6"×10"×12' "	4 "	6"×10"×14' "
5 "	6"×10"×13' "	3 "	6"×10"×15' "
4 "	6"×10"×14' "		

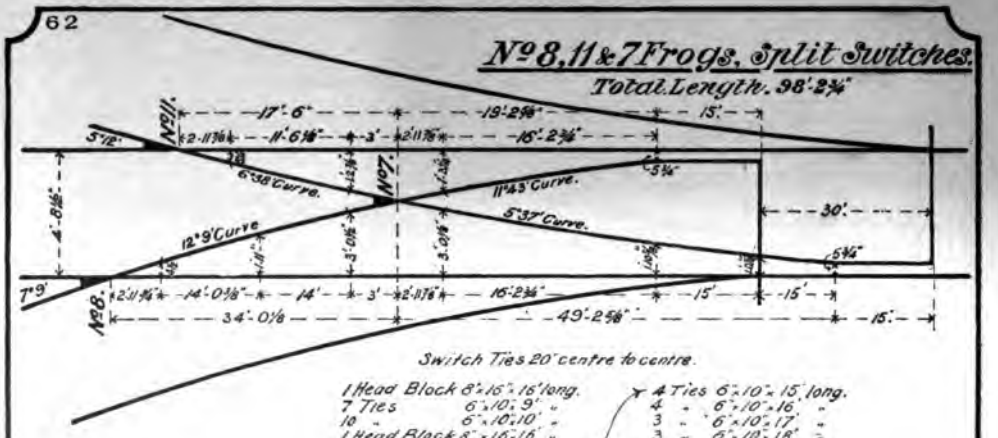
No 8, 12 & 7 Frogs, Split Switches.

Total Length. 88'.10"



No 8, 11 & 7 Frogs, Split Switches.

Total Length. 98'-2¾"

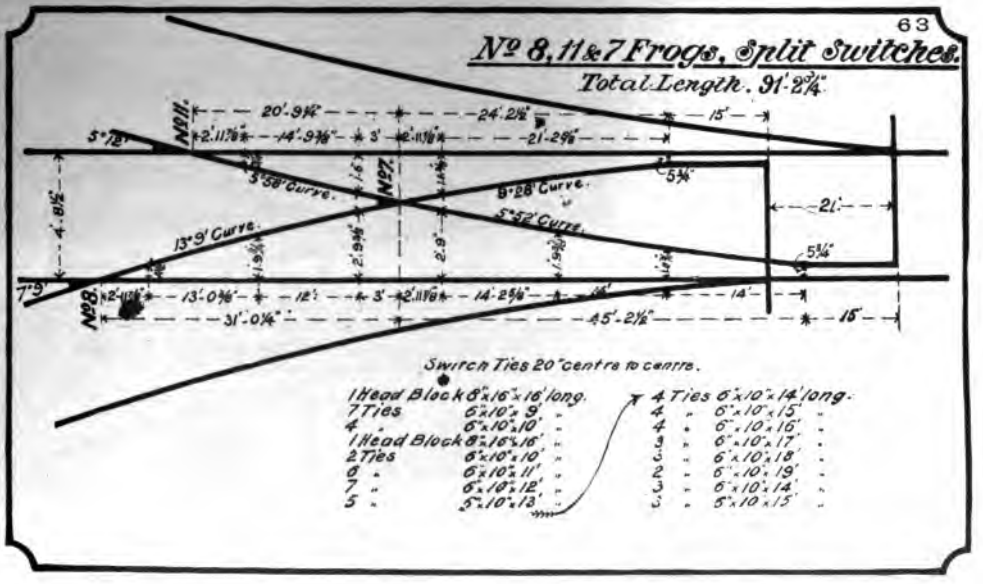


Switch Ties 20" centre to centre.

1 Head Block	8"x16"x16' long.	4 Ties	6"x10"x15' long.
7 Ties	6"x10"x9' "	4 "	6"x10"x16' "
10 "	6"x10"x10' "	3 "	6"x10"x17' "
1 Head Block	8"x16"x16' "	3 "	6"x10"x18' "
6 Ties	6"x10"x11' "	2 "	6"x10"x13' "
6 "	6"x10"x12' "	4 "	6"x10"x14' "
5 "	6"x10"x13' "	4 "	6"x10"x15' "
4 "	6"x10"x14' "		

No 8, 11 & 7 Frogs, Split Switches.

Total Length. 91'-2¾"

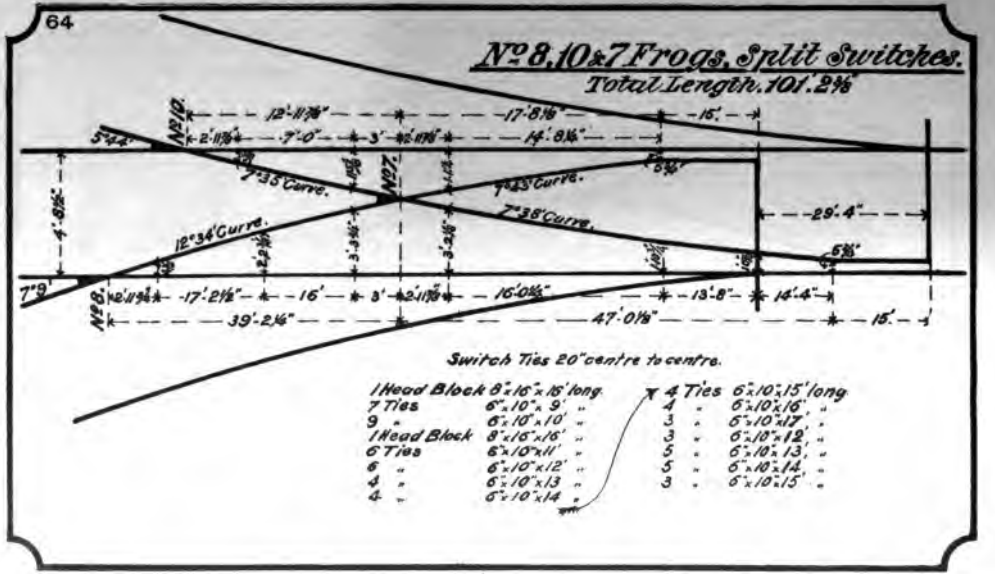


Switch Ties 20" centre to centre.

1 Head Block	8"x16"x16' long.	4 Ties	6"x10"x14' long.
7 Ties	6"x10"x9' "	4 "	6"x10"x15' "
4 "	6"x10"x10' "	4 "	6"x10"x16' "
1 Head Block	8"x16"x16' "	4 "	6"x10"x17' "
2 Ties	6"x10"x10' "	4 "	6"x10"x18' "
6 "	6"x10"x11' "	2 "	6"x10"x19' "
7 "	6"x10"x12' "	2 "	6"x10"x14' "
5 "	6"x10"x13' "	2 "	6"x10"x15' "

No 8, 10 & 7 Frogs, Split Switches.

Total Length. 101'. 2⅝

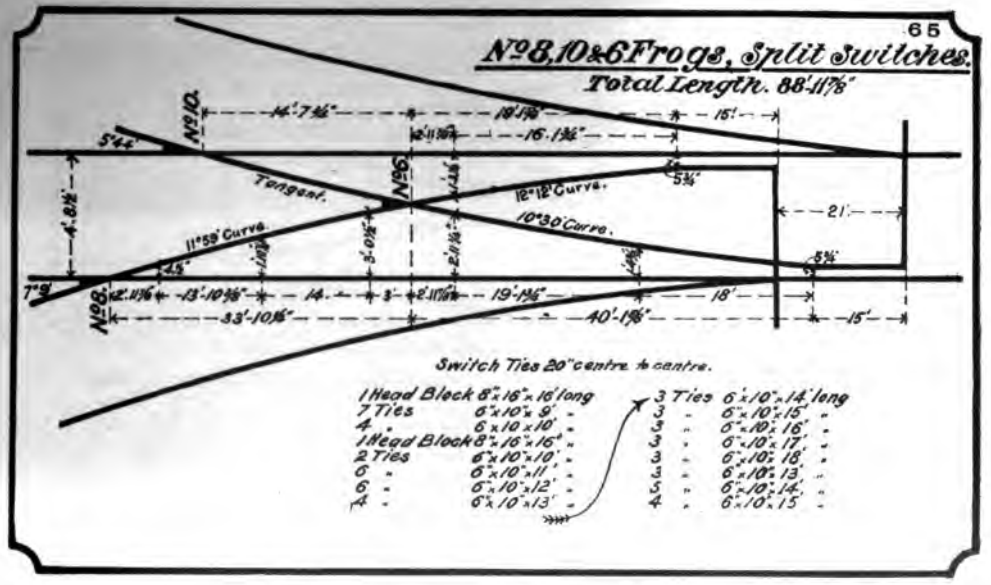


Switch Ties 20" centre to centre.

1 Head Block	8"×15"×15' long.	4 Ties	6"×10"×15' long.
7 Ties	6"×10"×9' "	4 "	6"×10"×16' "
9 "	6"×10"×10' "	3 "	6"×10"×17' "
1 Head Block	8"×15"×16' "	3 "	6"×10"×12' "
6 Ties	6"×10"×11' "	5 "	6"×10"×13' "
6 "	6"×10"×12' "	5 "	6"×10"×14' "
4 "	6"×10"×13 "	3 "	6"×10"×15' "
4 "	6"×10"×14 "		

No 8, 10 & 6 Frogs, Split Switches.

Total Length. 88'-11⅞"

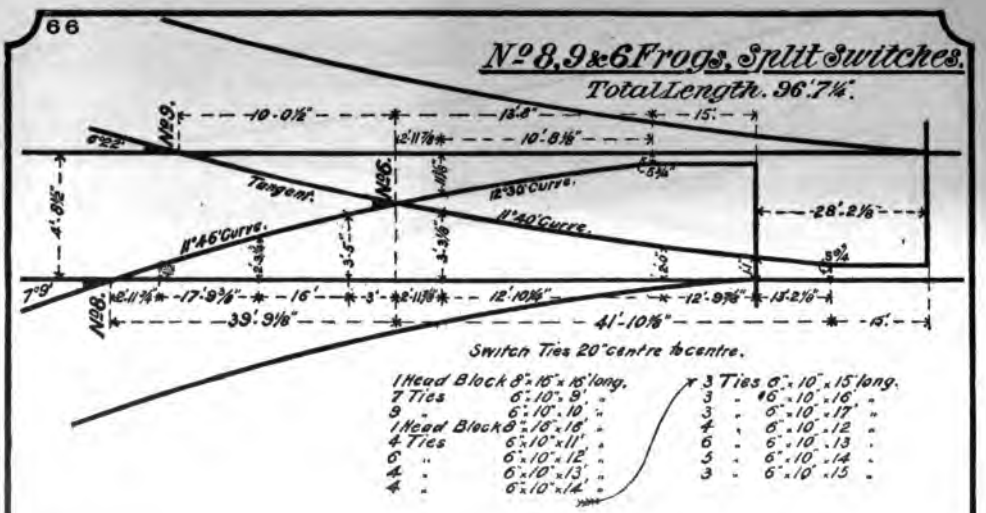


Switch Ties 20" centre to centre.

1 Head Block	8"x16"x16' long	3 Ties	6"x10"x14' long
7 Ties	6"x10"x9' "	3 "	6"x10"x15' "
4 "	6"x10"x10' "	3 "	6"x10"x16' "
1 Head Block	8"x16"x16" "	3 "	6"x10"x17' "
2 Ties	6"x10"x10' "	3 "	6"x10"x18' "
6 "	6"x10"x11' "	3 "	6"x10"x13' "
6 "	6"x10"x12' "	3 "	6"x10"x14' "
4 "	6"x10"x13' "	4 "	6"x10"x15' "

No 8, 9 & 6 Frogs, Split Switches.

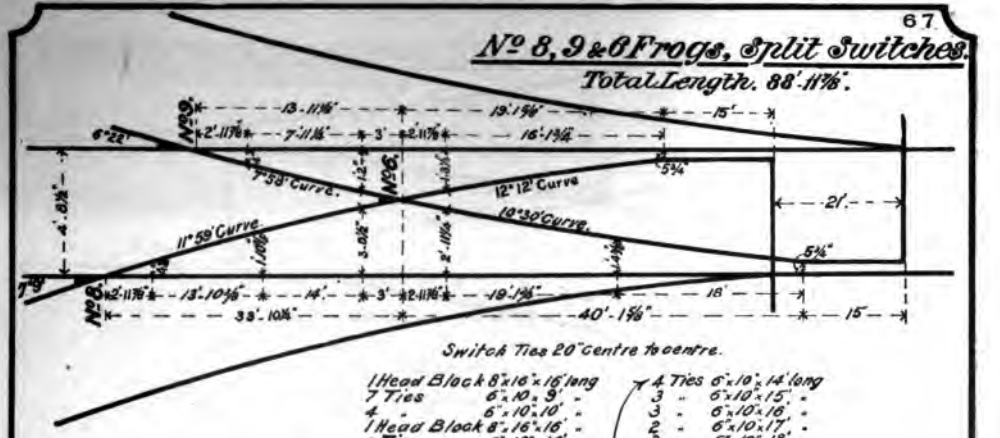
Total Length. 96'7½".



1 Head Block	8" × 15" × 15' long.	× 3 Ties	6" × 10" × 15' long.
7 Ties	6" × 10" × 9' "	3 "	6" × 10" × 16' "
9 "	6" × 10" × 10' "	3 "	6" × 10" × 17' "
1 Head Block	8" × 16" × 16' "	4 "	6" × 10" × 12' "
4 Ties	6" × 10" × 11' "	6 "	6" × 10" × 13' "
6 "	6" × 10" × 12' "	5 "	6" × 10" × 14' "
4 "	6" × 10" × 13' "	3 "	6" × 10" × 15' "
4 "	6" × 10" × 14' "		

No. 8, 9 & 6 Frogs, Split Switches.

Total Length. 88'-11⅞".

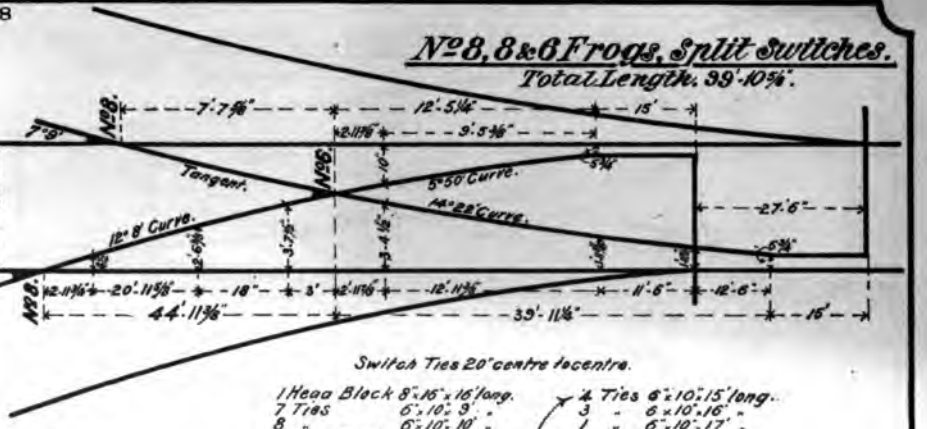


Switch Ties 20" Centre to centre.

1 Head Block	8"x16"x16' long	4 Ties	6"x10"x14' long
7 Ties	6"x10"x9' "	3 "	6"x10"x15' "
4 "	6"x10"x10' "	3 "	6"x10"x16' "
1 Head Block	8"x16"x16' "	2 "	6"x10"x17' "
3 Ties	6"x10"x10' "	3 "	6"x10"x18' "
6 "	6"x10"x11' "	4 "	6"x10"x13' "
5 "	6"x10"x12' "	5 "	6"x10"x14' "
4 "	6"x10"x13' "	3 "	6"x10"x15' "

No 8, 8 & 6 Frogs, Split Switches.

Total Length. 39'-10½".

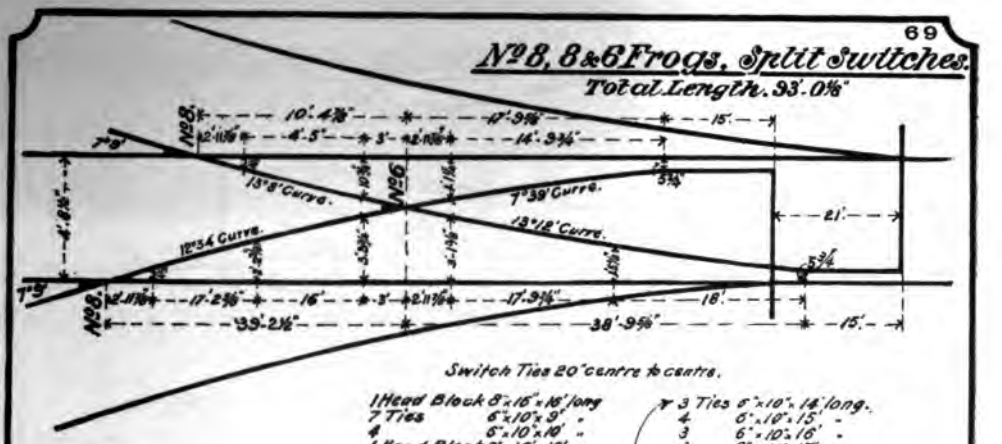


Switch Ties 20" centre to centre.

1 Head Block	8"×15"×16' long.		4 Ties	6"×10"×15' long.
7 Ties	6"×10"×9' "		3	"	6"×10"×16' "
8 "	6"×10"×10' "		1	"	6"×10"×17' "
1 Head Block	8"×15"×15' "		2	"	6"×10"×11' "
4 Ties	6"×10"×11' "		7	"	6"×10"×12' "
6 "	6"×10"×12' "		5	"	6"×10"×13' "
4 "	6"×10"×13' "		5	"	6"×10"×14' "
3 "	6"×10"×14' "		3	"	6"×10"×15 "

No 8, 8 & 6 Frogs, Split Switches.

Total Length. 93'. 0⅛"

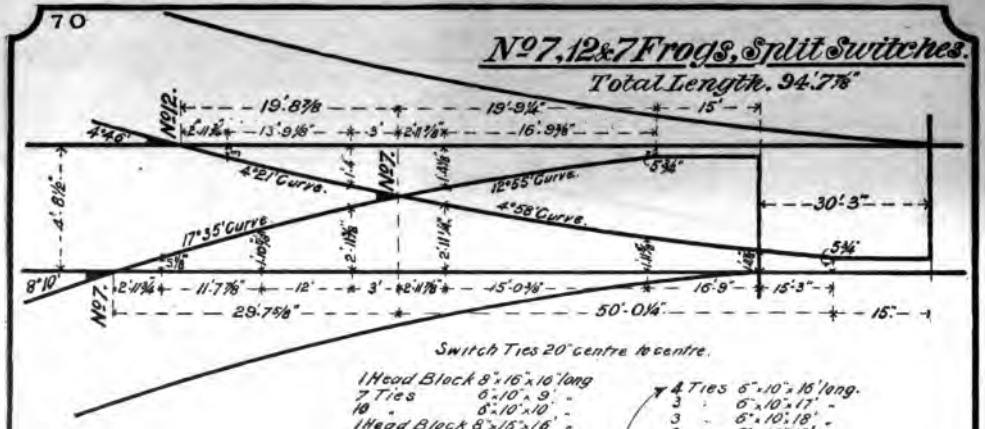


Switch Ties 20" centre to centre.

1 Head Block	8"x16"x18' long		3 Ties	6"x10"x14' long.	
7 Ties	6"x10"x9'	"	4	6"x10"x15'	"
4	6"x10"x10'	"	3	6"x10"x16'	"
1 Head Block	8"x16"x18'	"	3	6"x10"x17'	"
2 Ties	6"x10"x10'	"	4	6"x10"x12'	"
6	6"x10"x11'	"	5	6"x10"x13'	"
5	6"x10"x12'	"	5	6"x10"x14'	"
4	6"x10"x13'	"	3	6"x10"x15'	"

No 7, 12 & 7 Frogs, Split Switches.

Total Length. 94'.7⅞"

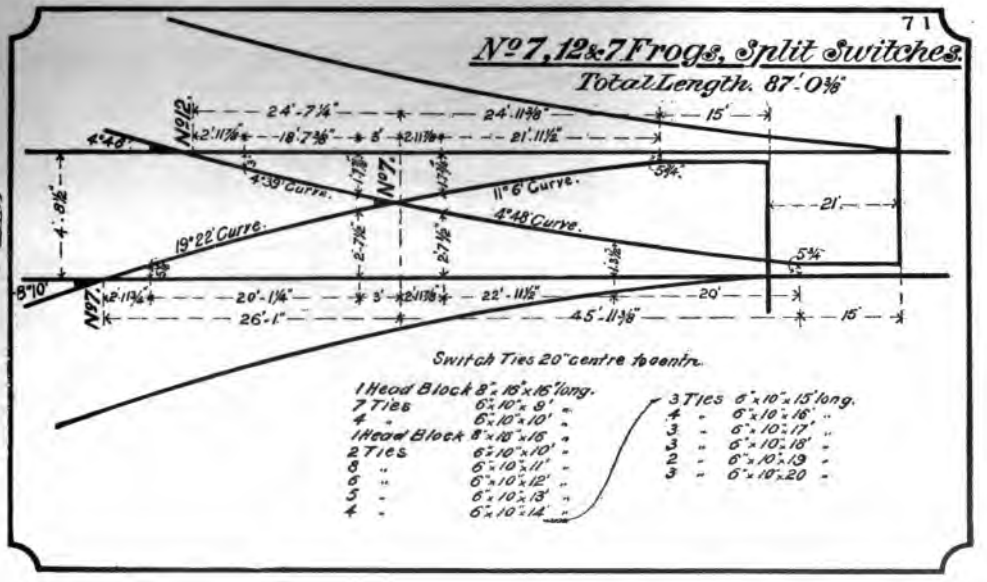


Switch Ties 20" centre to centre.

1 Head Block	8"×16"×16' long	4 Ties	6"×10"×15' long.
7 Ties	6"×10"×9' "	3 "	6"×10"×17' "
10 "	8"×10"×10' "	3 "	6"×10"×18' "
1 Head Block	8"×16"×16' "	2 "	6"×10"×19' "
6 Ties	6"×10"×11' "	2 "	6"×10"×14' "
6 "	6"×10"×12' "	3	5"×10"×15' "
5 "	6"×10"×13' "		
4 "	6"×10"×14' "		
4 "	6"×10"×15' "		

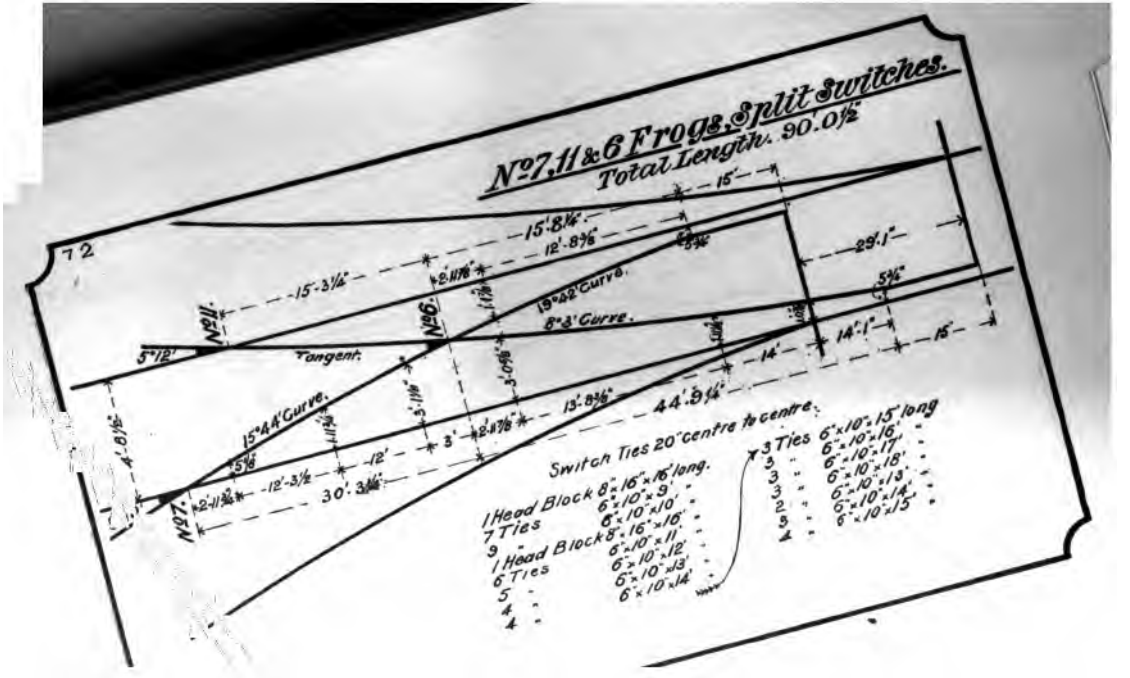
No 7, 12 & 7 Frogs, Split Switches.

Total Length. 87'-0⅜"



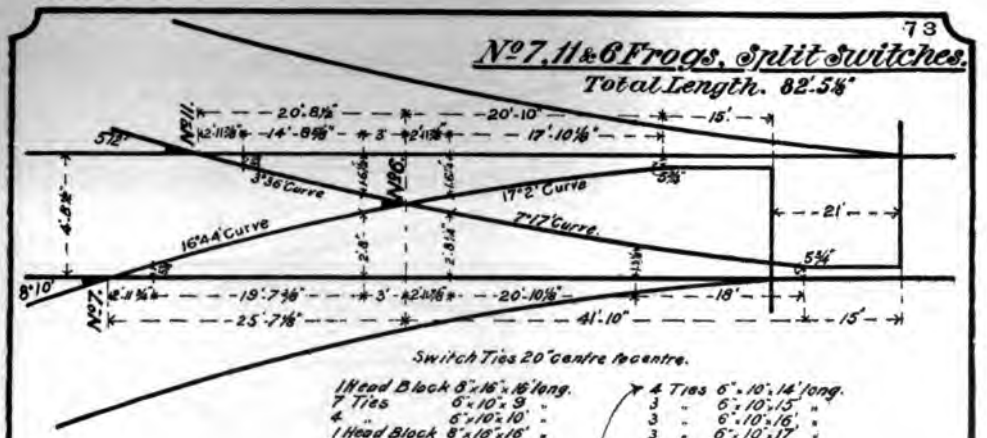
Switch Ties 20" centre to centre.

1 Head Block	8" x 16" x 15' long.	3 Ties	6" x 10" x 15' long.
7 Ties	6" x 10" x 9' "	4 "	6" x 10" x 16' "
4 "	6" x 10" x 10' "	3 "	6" x 10" x 17' "
1 Head Block	8" x 16" x 16' "	3 "	6" x 10" x 18' "
2 Ties	6" x 10" x 10' "	2 "	6" x 10" x 19' "
3 "	6" x 10" x 11' "	3 "	6" x 10" x 20' "
3 "	6" x 10" x 12' "		
3 "	6" x 10" x 13' "		
4 "	6" x 10" x 14' "		


No 7, 11 & 6 Frogs, Split Switches.
Total Length. 90.0½
72
No 11
No 6
No 7
5°12'
Tangent.
15°44' Curve.
19°22' Curve.
8°3' Curve.
15'-8¼"
12'-8⅞"
15'-3¼"
29.1"
5¼"
14'-1"
15'
44'-5¼"
30'-3⅛"
Switch Ties 20" centre to centre.
1 Head Block 8"×16"×16' long.
7 Ties 6"×10"×9'
9 " 6"×10"×10'
1 Head Block 8"×16"×16'
6 Ties 6"×10"×11'
5 " 6"×10"×12'
4 " 6"×10"×13'
4 " 6"×10"×14'
3 Ties 6"×10"×15' long
3 " 6"×10"×16' "
3 " 6"×10"×17' "
3 " 6"×10"×18' "
2 " 6"×10"×13' "
3 " 6"×10"×14' "
4 " 6"×10"×15' "

No 7, 11 & 6 Frogs, Split Switches.

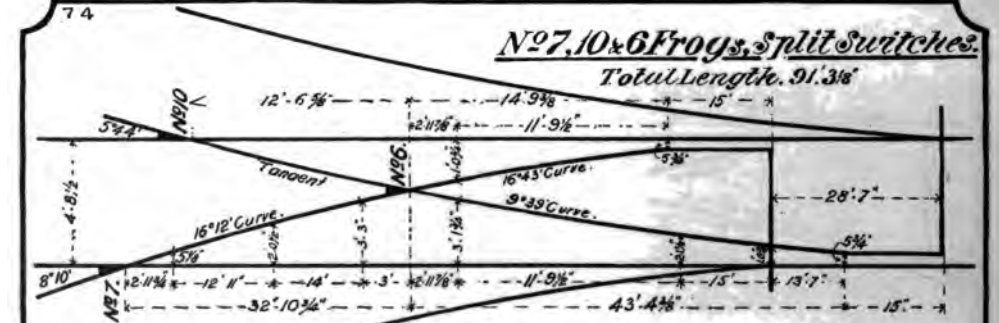
Total Length. 82'.5⅛"



1 Head Block	8"×16"×16' long.	4 Ties	6"×10"×14' long.
7 Ties	6"×10"×9' "	3 "	6"×10"×15' "
4 "	6"×10"×10' "	3 "	6"×10"×16' "
1 Head Block	8"×16"×16' "	3 "	6"×10"×17' "
2 Ties	6"×10"×10' "	3 "	6"×10"×18' "
7 "	6"×10"×11' "	3 "	6"×10"×19' "
5 "	6"×10"×12' "	1 "	6"×10"×20' "
4 "	6"×10"×13' "	3 "	6"×10"×15' "

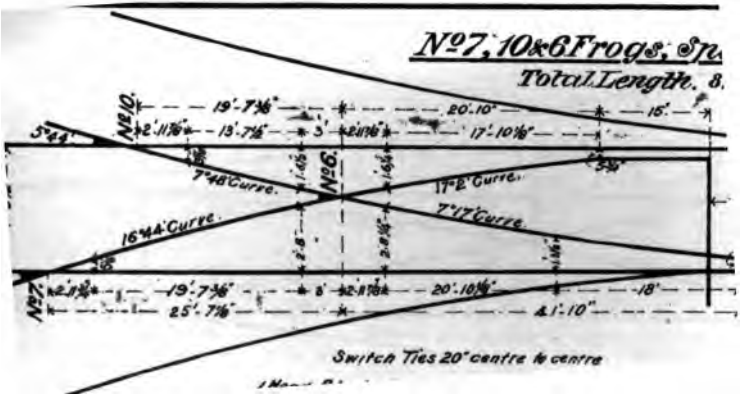
No 7, 10×6 Frogs, Split Switches.

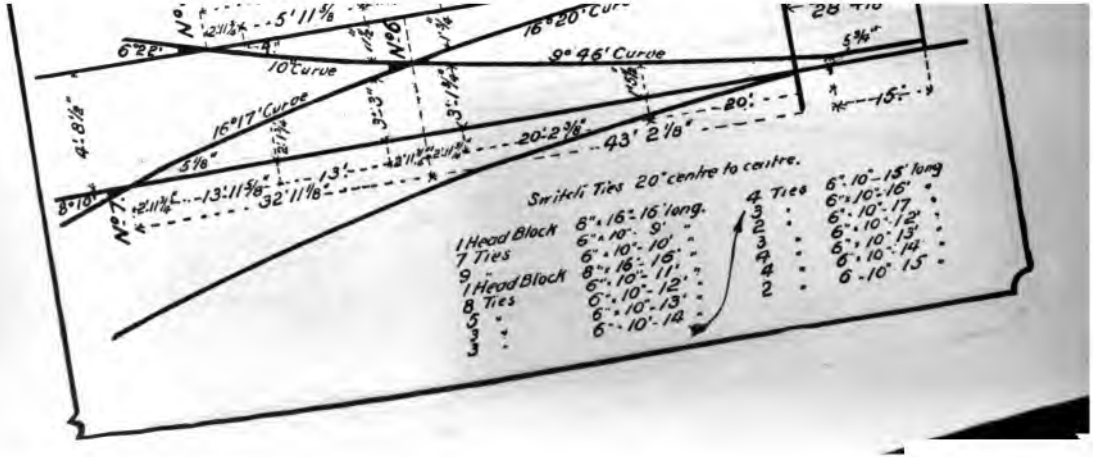
Total Length. 91'.3⅛"



Switch Ties 20" centre to centre.

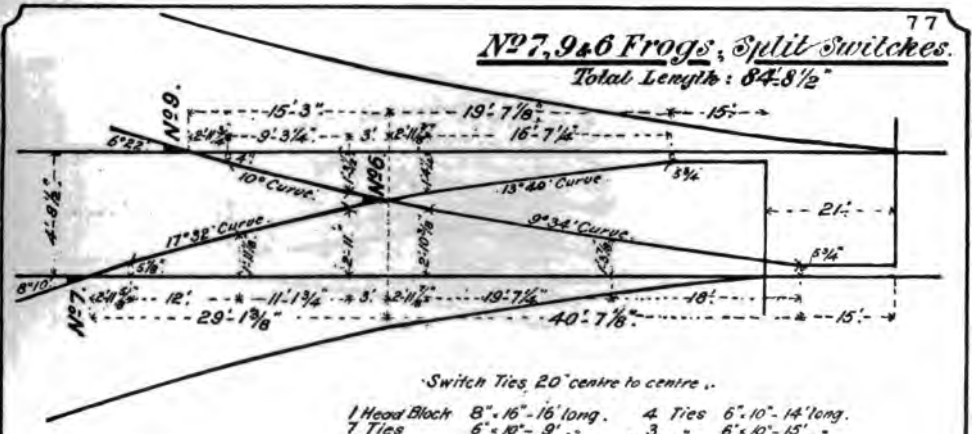
1 Head Block	8"×10"×16' long.		
7 Ties	6"×10"×9' "	4 Ties	6"×10"×15' long
9 "	6"×10"×10' "	3 "	6"×10"×16' "
1 Head Block	8"×10"×16' "	3 "	6"×10"×17' "
6 Ties	6"×10"×11' "	2 "	6"×10"×18' "
5 "	6"×10"×12' "	3 "	6"×10"×13' "
4 "	6"×10"×13' "	5 "	6"×10"×14' "
3 "	6"×10"×14' "	4 "	6"×10"×15' "


No7, 10×6 Frogs, Sn
Total Length. 8.
No10.
No6.
No2.
19'-7⅜"
20'-10"
15'-
12'-11⅝"
13'-7½"
3'
12'-11⅝"
17'-10⅛"
5°44'
7°48' Curve.
17°2' Curve.
16°44' Curve.
7°17' Curve.
19'-7⅜"
20'-10⅛"
18'-
25'-7⅛"
41'-10"
Switch Ties 20" centre to centre


16°20' Curve
9° 46' Curve
16° 17' Curve
10° Curve
5' 11 5/8"
6° 2½'
5 3/16"
4' 8½"
8° 18"
5 3/8"
13' 11 5/8"
32' 11 1/8"
20' 2 3/8"
43' 2 1/8"
20'
15'
Switch Ties 20" centre to centre.
1 Head Block 8" x 16" 16' long.
7 Ties 6" x 10" 9' "
9 " 6" x 10" 10' "
1 Head Block 8" x 16" 16' "
8 Ties 8" x 16" 11' "
6" x 10" 12' "
6" x 10" 13' "
6" x 10" 14' "
4 Ties 6" x 10" 15' long
3 " 6" x 10" 16' "
2 " 6" x 10" 17' "
3 " 6" x 10" 12' "
4 " 6" x 10" 13' "
2 " 6" x 10" 14' "
6" x 10" 15 "

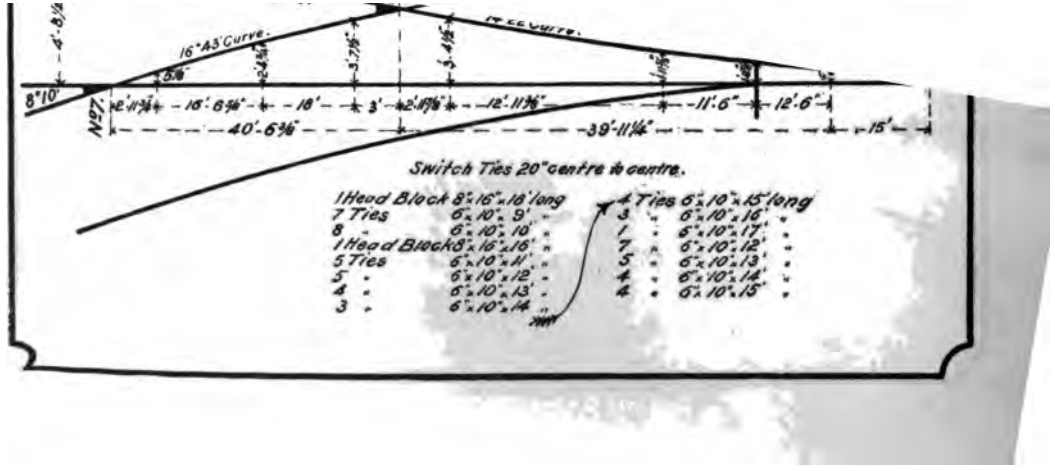
No 7, 9 & 6 Frogs, Split Switches.

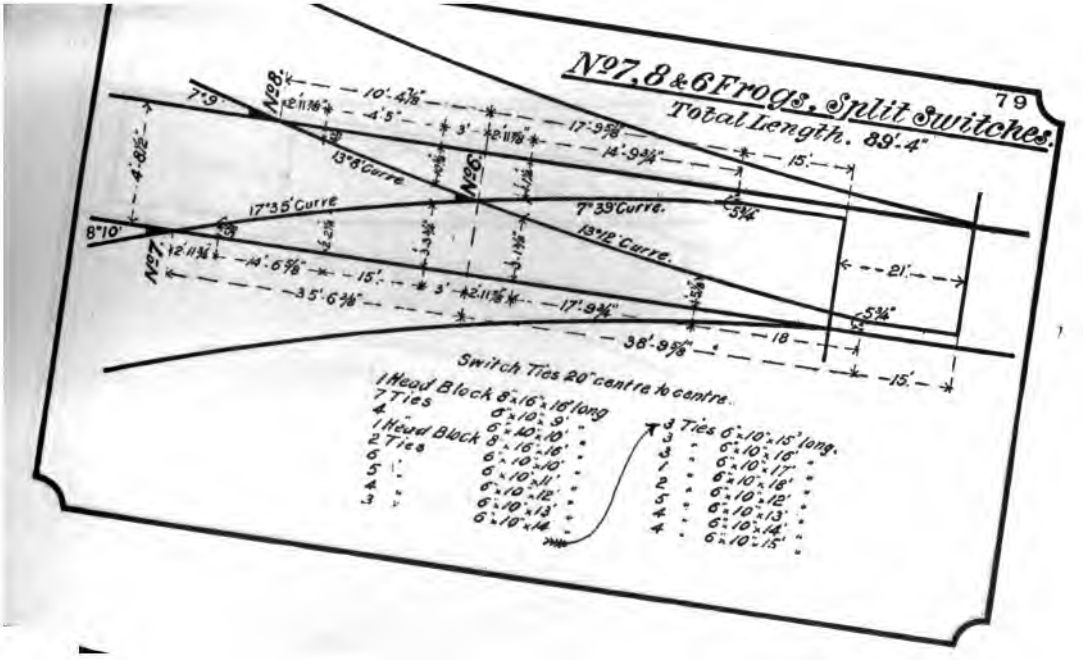
Total Length: 84'-8½"

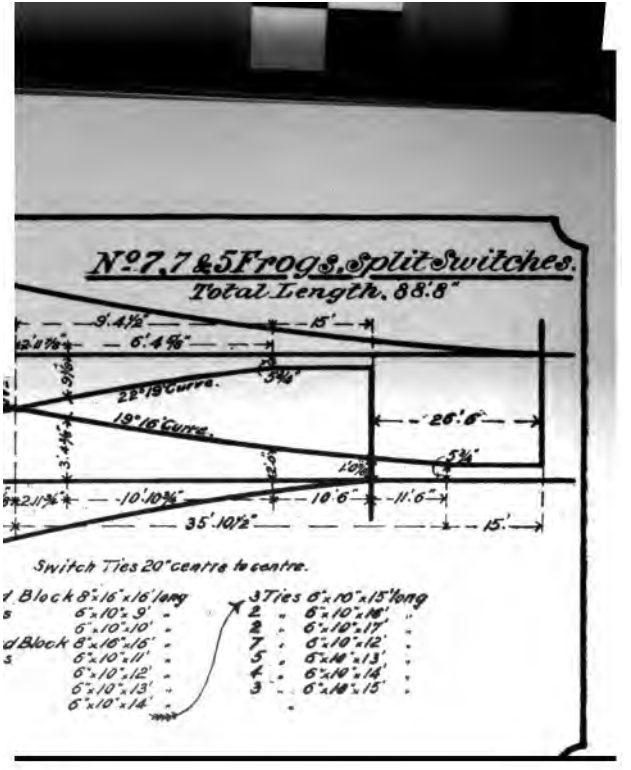


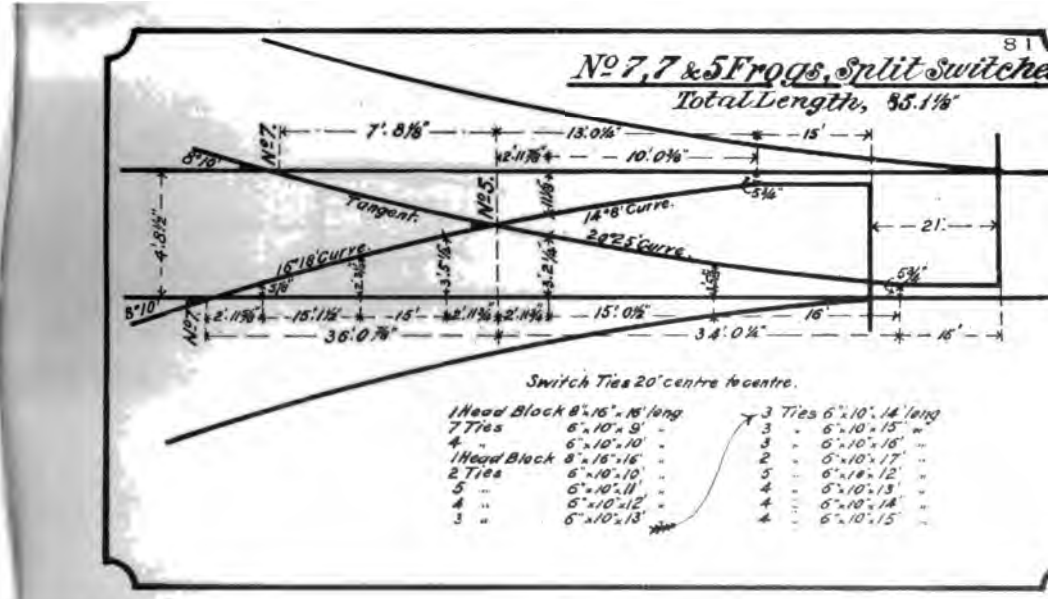
"Switch Ties 20" centre to centre."

1 Head Block	8" × 16" - 16' long.		4	Ties	6" × 10" - 14' long.
7 Ties	6" × 10" - 9' "		3	"	6" × 10" - 15' "
4 "	6" × 10" - 10' "		3	"	6" × 10" - 16' "
1 Head Block	8" × 16" - 16' "		3	"	6" × 10" - 17' "
3 Ties	6" × 10" - 10' "		3	"	6" × 10" - 18' "
6 "	6" × 10" - 11' "		3	"	6" × 10" - 13' "
5 "	6" × 10" - 12' "		4	"	6" × 10" - 14' "
4 "	6" × 10" - 13' "		3		6" × 10" - 15' "


16°43' Curve.
8°10'
No 7.
40'-6⅜"
39'-11¼"
15'
Switch Ties 20" centre to centre.
1 Head Block 8"x16"x16' long
7 Ties 6"x10"x9' "
8 " 6"x10"x10' "
1 Head Block 8"x16"x16' "
5 Ties 6"x10"x11' "
5 " 6"x10"x12' "
4 " 6"x10"x13' "
3 " 6"x10"x14' "
4 Ties 6"x10"x15' long
3 " 6"x10"x16' "
1 " 6"x10"x17' "
7 " 6"x10"x12' "
5 " 6"x10"x13' "
4 " 6"x10"x14' "
4 " 6"x10"x15' "

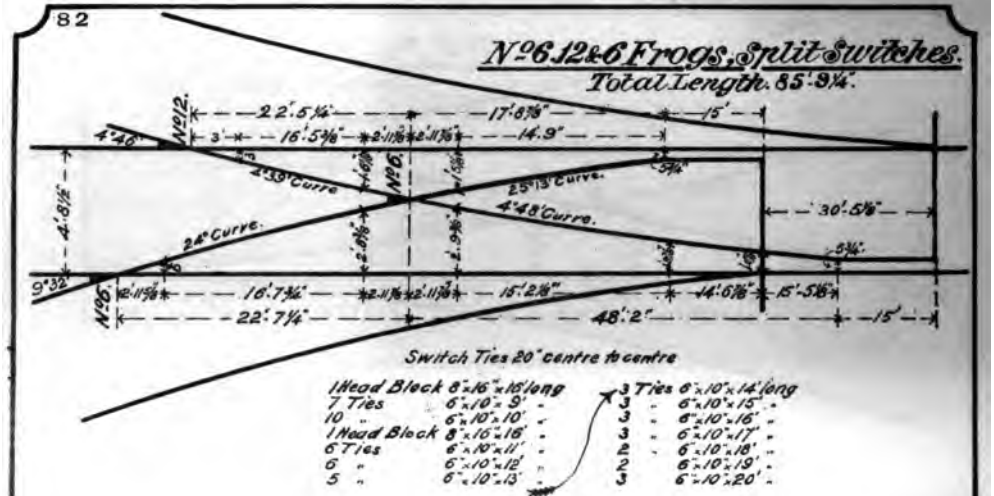

No7, 8 & 6 Frogs, Split Switches.
Total Length. 89'.4"
No8.
No6.
No7.
7°9'
8°10'
17°35' Curve
13°8' Curve
7°39' Curve.
13°12' Curve.
10'-4⅞"
4'-8½"
17'-9⅝"
14'-9¾"
15'
21'
38'-9⅝"
18
Switch Ties 20" centre to centre.
1 Head Block 8"x16"x18" long
7 Ties 6"x10"x9" "
4 " 6"x10"x10' "
1 Head Block 8"x16"x16" "
2 Ties 6"x10"x10" "
6 " 6"x10"x11" "
5 " 6"x10"x12" "
4 " 6"x10"x13" "
3 " 6"x10"x14" "
3 Ties 6"x10"x15' long.
3 " 6"x10"x16" "
1 " 6"x10"x17" "
2 " 6"x10"x18" "
5 " 6"x10"x12" "
4 " 6"x10"x13" "
4 " 6"x10"x14" "
6"x10"x15" "


No. 7, 7 & 5 Frogs, Split Switches.
Total Length. 88.8"
9'.4½"
15'
6'.4⅝"
9⅛"
3¾"
22°.19' Curve.
19°.16' Curve.
26'.6"
3'.4½"
5¾"
10'.10¾"
10'.6"
11'.6"
35'.10½"
15'
Switch Ties 20" centre to centre.
Block 8"x16"x16' long
6"x10"x9'
6"x10"x10'
Block 8"x16"x16'
6"x10"x11'
6"x10"x12'
6"x10"x13'
6"x10"x14'
3 Ties 6"x10"x15' long
2 " 6"x10"x16'
2 " 6"x10"x17'
7 " 6"x10"x12'
5 " 6"x10"x13'
4 " 6"x10"x14'
3 " 6"x10"x15'


No 7, 7 & 5 Frogs, Split Switche
Total Length, 85.1½"
7'.8⅛"
13.0⅛"
15'
2'.11⅞"
10'.0⅛"
No 7
No 5
8°13'
Tangent.
14°8' Curve.
20°25' Curve.
16°18' Curve.
4'.8½"
21"
5¾"
8°10'
2'.11⅞"
15'.11½"
15'
2'.11⅞"
2'.11⅞"
15'.0½"
16'
36'.0⅞"
34'.0¼"
15'
Switch Ties 20" centre to centre.
1 Head Block 8"x16"x15' long
7 Ties 6"x10"x9' "
4 " 6"x10"x10' "
1 Head Block 8"x16"x16' "
2 Ties 6"x10"x10' "
5 " 6"x10"x11' "
4 " 6"x10"x12' "
3 " 6"x10"x13' "
3 Ties 6"x10"x14' long
3 " 6"x10"x15' "
3 " 6"x10"x16' "
2 " 6"x10"x17' "
5 " 6"x10"x12' "
4 " 6"x10"x13' "
4 " 6"x10"x14' "
4 " 6"x10"x15' "

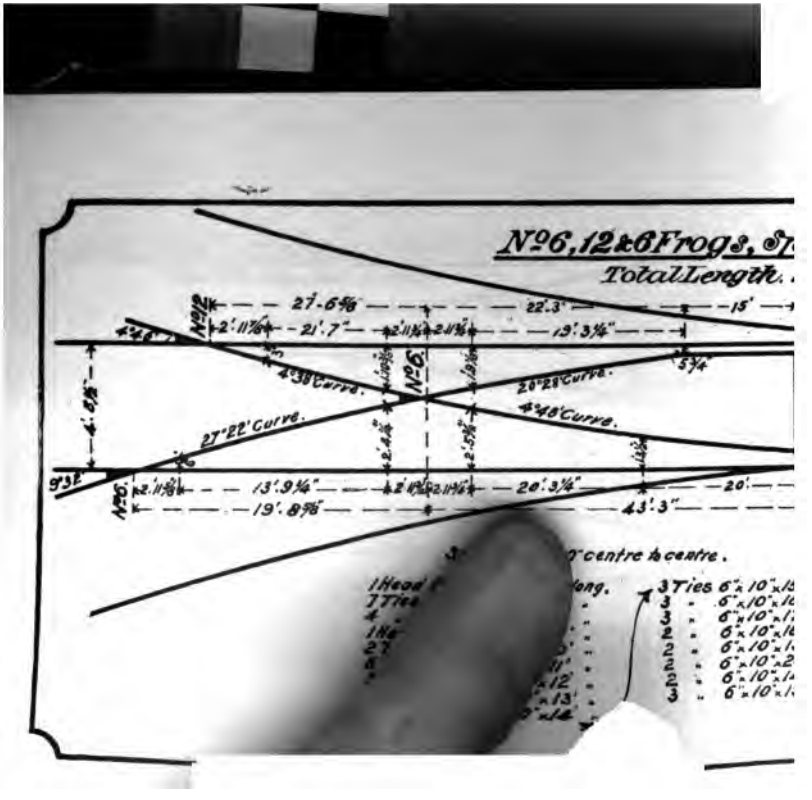
No 6 12 & 6 Frogs, Split Switches.

Total Length. 85'-9¼".



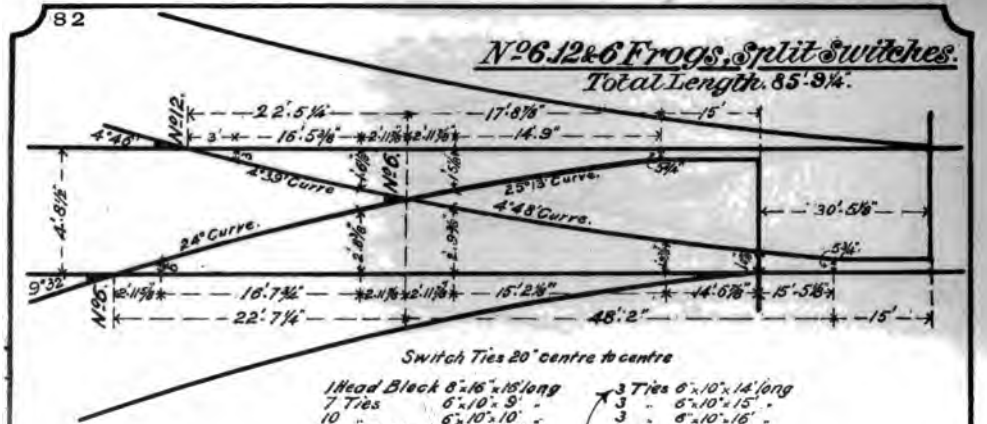
Switch Ties 20" centre to centre

1 Head Block	8"×16"×15' long	3 Ties	6"×10"×14' long
7 Ties	6"×10"× 9' "	3 "	6"×10"×15' "
10 "	6"×10"×10' "	3 "	6"×10"×16' "
1 Head Block	8"×16"×16' "	3 "	6"×10"×17' "
6 Ties	6"×10"×11' "	2 "	6"×10"×18' "
6 "	6"×10"×12' "	2 "	6"×10"×19' "
5 "	6"×10"×13' "	3 "	6"×10"×20' "


No6,12&6Frogs,St
TotalLength.
No12
No6
27'-6⅝
22'3"
15'
21'7"
19'3¼"
4°38'Curve.
20°28'Curve.
27°22'Curve.
4°48'Curve.
5¾
4'4⅝"
9°32'
13'9¼"
20'3¼"
20'
19'8⅝"
43'3"
centre to centre.
long.
1 Head
7 Ties
4
1 He
2
6
3 Ties 6"x10"x
3 " 6"x10"x
3 " 6"x10"x
2 " 6"x10"x
" 6"x10"x
" 6"x10"x2
3 " 6"x10"x
" 6"x10"x

No 6 12 & 6 Frogs, Split Switches.

Total Length. 85'-9¼".

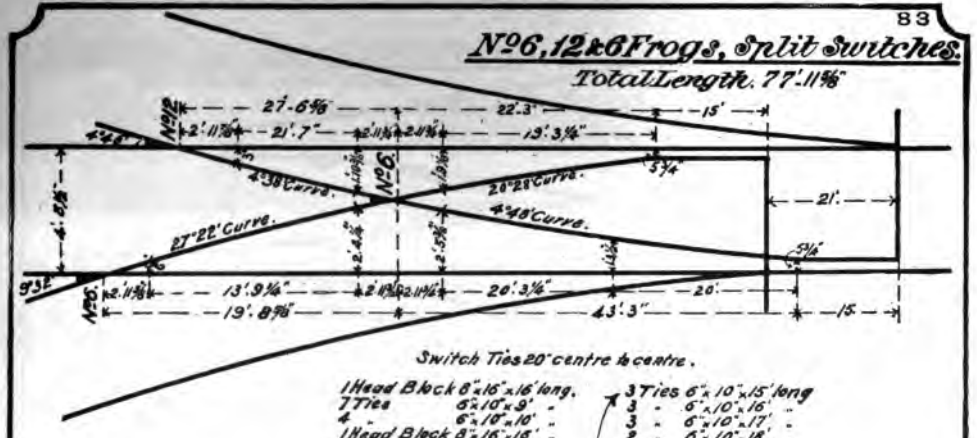


Switch Ties 20" centre to centre

1 Head Block	8"×16"×15' long		3 Ties	6"×10"×14' long
7 Ties	6"×10"×9' "		3 "	6"×10"×15' "
10 "	6"×10"×10' "		3 "	6"×10"×16' "
1 Head Block	8"×16"×16' "		3 "	6"×10"×17' "
6 Ties	6"×10"×11' "		2 "	6"×10"×18' "
6 "	6"×10"×12' "		2	6"×10"×19' "
5 "	6"×10"×13' "		3	6"×10"×20' "

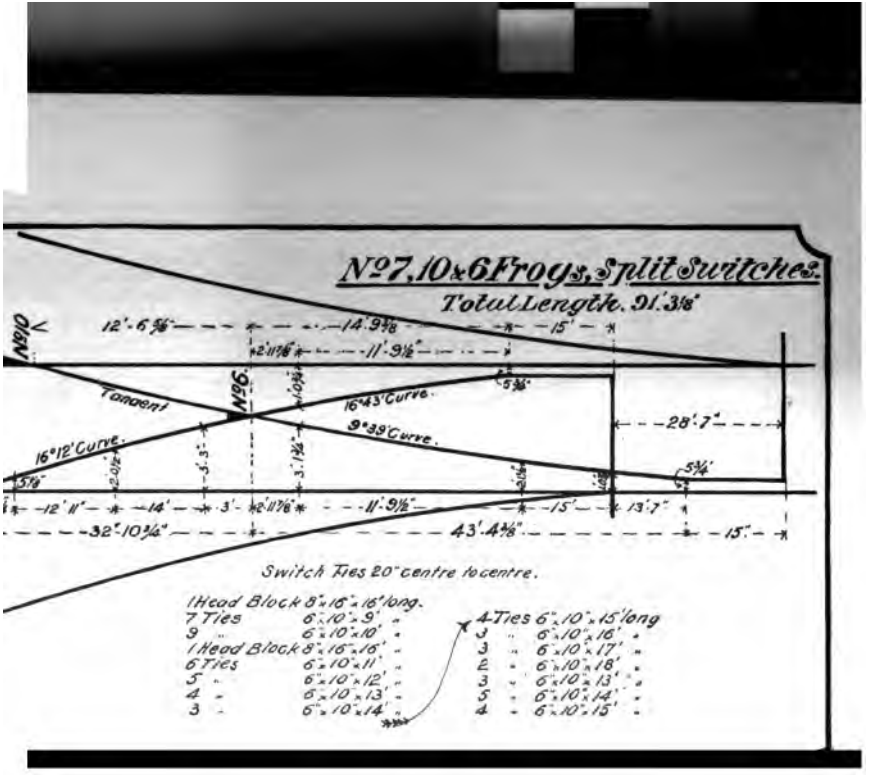
No 6, 12 & 6 Frogs, Split Switches.

Total Length. 77'.11⅝"



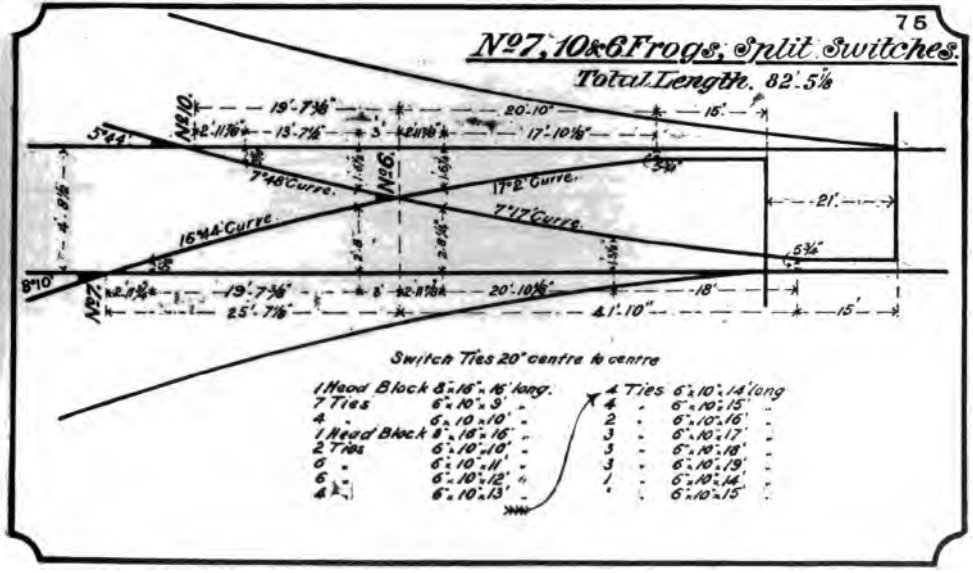
Switch Ties 20" centre to centre.

1 Head Block	6"x16"x16' long.	3 Ties	6"x10"x15' long
7 Ties	6"x10"x9' "	3 "	6"x10"x16' "
4 "	6"x10"x10' "	3 "	6"x10"x17' "
1 Head Block	8"x16"x16' "	2 "	6"x10"x18' "
2 Ties	6"x10"x10' "	2 "	6"x10"x19' "
6 "	6"x10"x11' "	2 "	6"x10"x20' "
5 "	6"x10"x12' "	2 "	6"x10"x14' "
4 "	6"x10"x13' "	3 "	6"x10"x15' "
4 "	6"x10"x14' "		


No7, 10×6 Frogs, Split Switches.
Total Length. 91'.3⅛"
Open
12'-6⅝"
14'.9⅞"
15'
2'.11⅞"
11'.9½"
No6.
Tangent
16°43' Curve.
9°39' Curve.
16°12' Curve.
5⅜"
28'.7"
5¾"
12'.11"
14'
3'
11'.9½"
15'
13'.7"
32'.10¼"
43'.4⅛"
Switch Ties 20" centre to centre.
1 Head Block 8"×16"×16' long.
7 Ties 6"×10"×9' "
9 " 6"×10"×10' "
1 Head Block 8"×16"×16' "
6 Ties 6"×10"×11' "
5 " 6"×10"×12' "
4 " 6"×10"×13' "
3 " 6"×10"×14' "
4 Ties 6"×10"×15' long
3 " 6"×10"×16' "
3 " 6"×10"×17' "
2 " 6"×10"×18' "
3 " 6"×10"×13' "
5 " 6"×10"×14' "
4 " 6"×10"×15' "

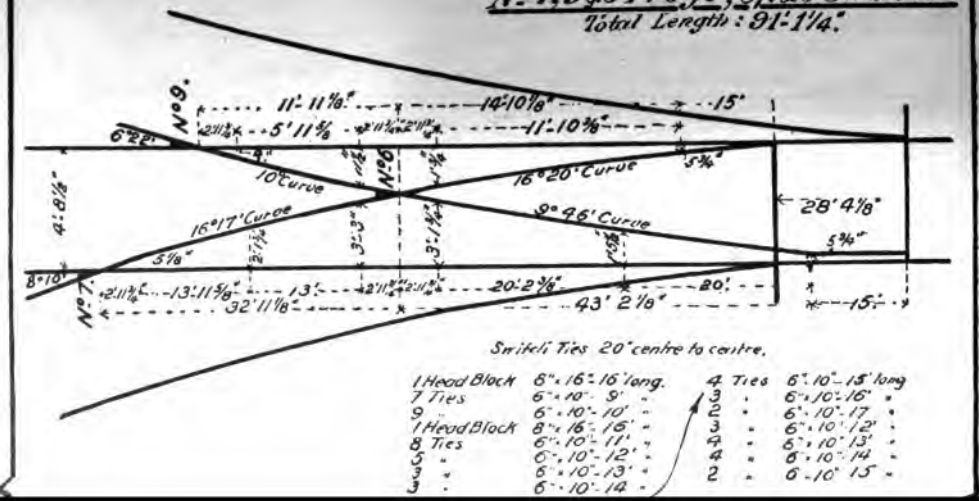
No 7, 10 & 6 Frogs, Split Switches.

Total Length. 82'.5⅛



No 7, 9 & 6 Frogs; Split Switches

Total Length: 91'-1¼"

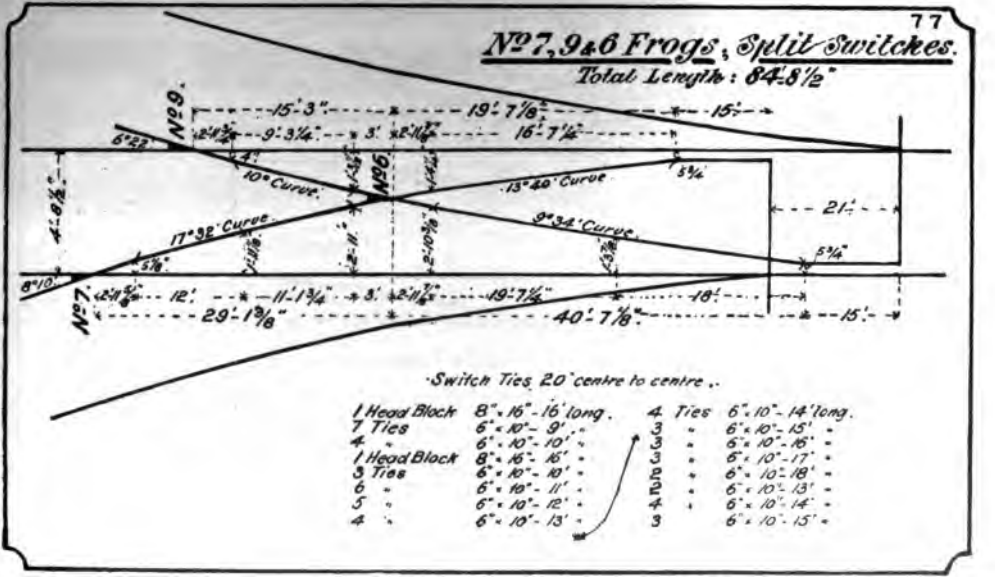


Switch Ties 20" centre to centre.

1 Head Block	6" × 16" × 16' long.	4 Ties	6" × 10" × 15' long
7 Ties	6" × 10" × 9' "	3 "	6" × 10" × 16' "
9 "	6" × 10" × 10' "	2 "	6" × 10" × 17' "
1 Head Block	8" × 16" × 16' "	3 "	6" × 10" × 12' "
8 Ties	6" × 10" × 11' "	4 "	6" × 10" × 13' "
5 "	6" × 10" × 12' "	4 "	6" × 10" × 14' "
4 "	6" × 10" × 13' "	2 "	6" × 10" × 15' "
3 "	6" × 10" × 14' "		

No 7, 9 & 6 Frogs, Split Switches.

Total Length: 84'-8½"



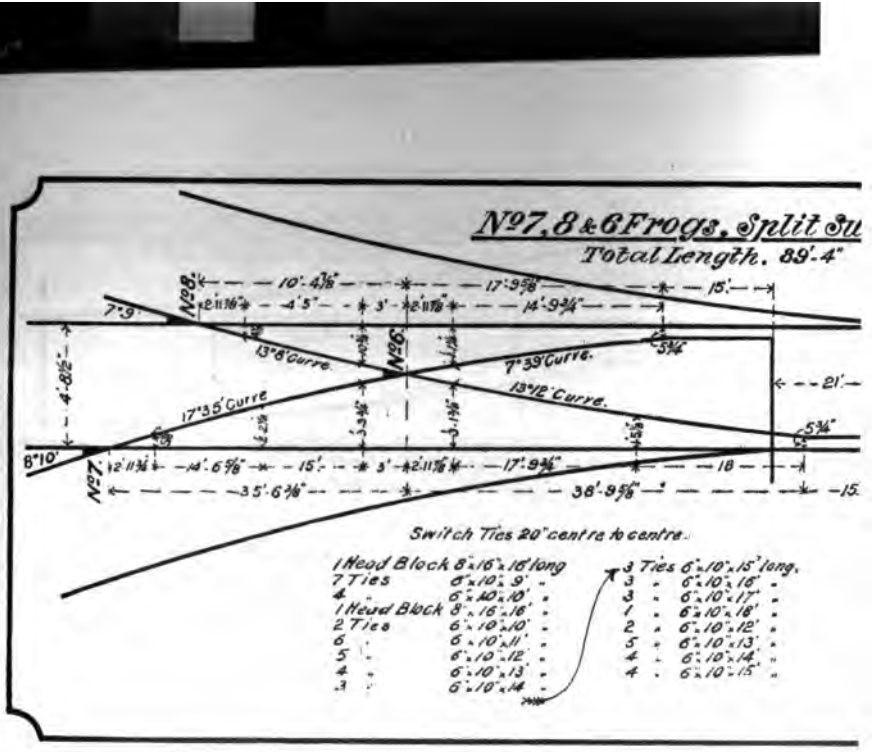
·Switch Ties 20" centre to centre..

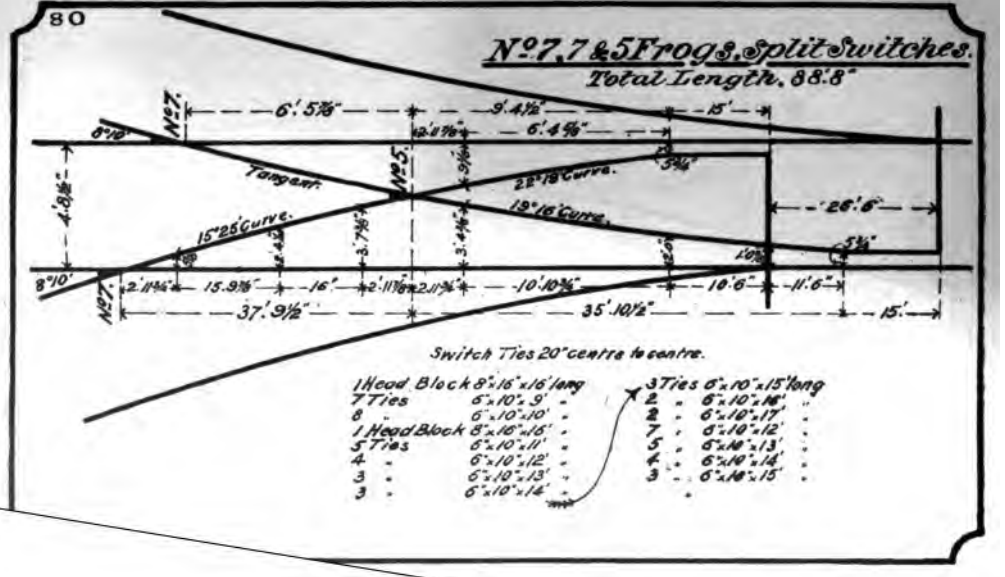
1 Head Block	8" × 16" - 16' long.		4	Ties	6" × 10" - 14' long.
7 Ties	6" × 10" - 9' "		3	"	6" × 10" - 15' "
4 "	6" × 10" - 10' "		1	"	6" × 10" - 16' "
1 Head Block	8" × 16" - 16' "	Rail Curve	1	"	6" × 10" - 17' "
3 Ties	6" × 10" - 10' "		1	"	6" × 10" - 18' "
6 "	6" × 10" - 11' "		1	"	6" × 10" - 13' "
5 "	6" × 10" - 12' "		4	"	6" × 10" - 14' "
4 "	6" × 10" - 13' "		3		6" × 10" - 15' "

No 7, 8 x 6 Frogs, Split Switches.

Total Length. 95'-5⅝".

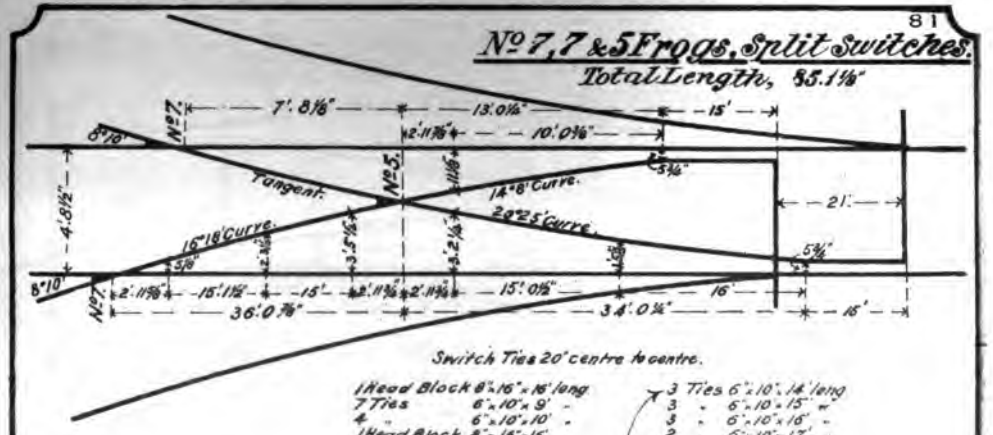
1 Head Block	8" x 16" x 16' long	4 Ties	6" x 10" x 15' long
7 Ties	6" x 10" x 9' "	3 "	6" x 10" x 16' "
8 "	6" x 10" x 10' "	1 "	6" x 10" x 17' "
1 Head Block	8" x 16" x 16' "	7 "	6" x 10" x 12' "
5 Ties	6" x 10" x 11' "	5 "	6" x 10" x 13' "
5 "	6" x 10" x 12' "	4 "	6" x 10" x 14' "
4 "	6" x 10" x 13' "	4 "	6" x 10" x 15' "
3 "	6" x 10" x 14' "		


No7, 8 & 6 Frogs, Split Su
Total Length. 89'-4"
No8.
No6.
No7.
10'-4⅛"
17'-9⅝"
15'-
4'-5"
3'
2'-11⅞"
14'-9¾"
7°-9'
13°-8' Curve.
7°-39' Curve.
13°-12' Curve.
17°-35' Curve
21'-
5¾"
4'-8½"
8°-10'
12-11¾"
14'-6⅝"
15'-
17'-9¾"
18
35'-6⅛"
38'-9⅝"
Switch Ties 20" centre to centre.
1 Head Block 8"x16"x16' long
7 Ties 6"x10"x9' "
4 " 6"x10"x10' "
1 Head Block 8"x16"x16' "
2 Ties 6"x10"x10' "
6 " 6"x10"x11' "
5 " 6"x10"x12' "
4 " 6"x10"x13' "
3 " 6"x10"x14' "
3 Ties 6"x10"x15' long.
3 " 6"x10"x16' "
3 " 6"x10"x17' "
1 " 6"x10"x18' "
2 " 6"x10"x12' "
5 " 6"x10"x13' "
4 " 6"x10"x14' "
4 " 6"x10"x15' "


No. 7, 7 & 5 Frogs, Split Switches.
Total Length. 88.8"
No.7.
No.5.
No.7.
6'.5⅞"
9'.4½"
15'
6'.4⅝"
8°18'
Tangent.
22°18' Curve.
19°16' Curve.
15°25' Curve.
4'.8½"
26'.6"
8°10'
37'.9½"
35'.10½"
15'.
Switch Ties 20" centre to centre.
1 Head Block 8"x16"x16' long
7 Ties 6"x10"x9' "
8 " 6"x10"x10' "
1 Head Block 8"x16"x15' "
5 Ties 6"x10"x11' "
4 " 6"x10"x12' "
3 " 6"x10"x13' "
3 " 6"x10"x14' "
3 Ties 6"x10"x15' long
2 " 6"x10"x16' "
2 " 6"x10"x17' "
7 " 6"x10"x12' "
5 " 6"x10"x13' "
4 " 6"x10"x14' "
3 " 6"x10"x15' "

No 7, 7 & 5 Frogs, Split Switches.

Total Length, 85.1⅛"

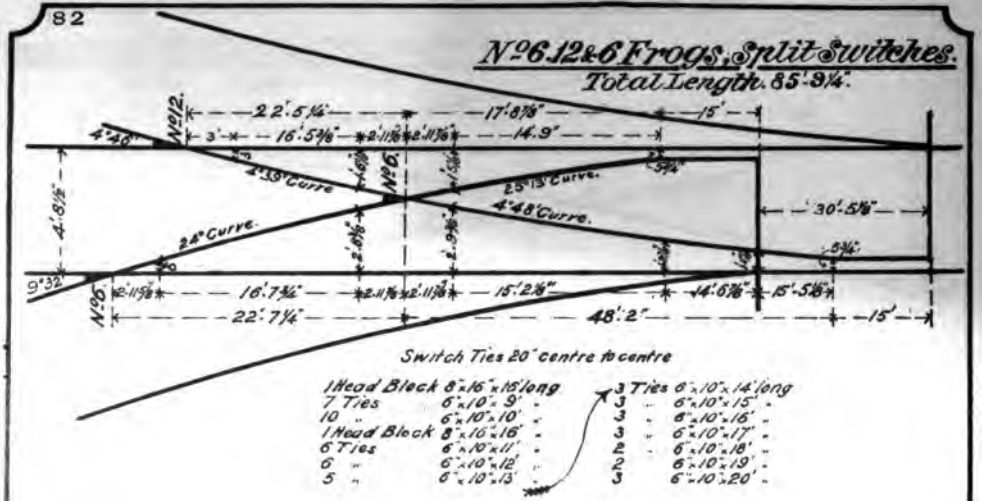


Switch Ties 20" centre to centre.

1 Head Block	8"×16"×16' long	3 Ties	6"×10"×14' long
7 Ties	6"×10"×9' "	3 "	6"×10"×15' "
4 "	6"×10"×10' "	3 "	6"×10"×16' "
1 Head Block	8"×16"×16' "	2 "	6"×10"×17' "
2 Ties	6"×10"×10' "	5 "	6"×14"×12' "
5 "	6"×10"×11' "	4 "	6"×10"×13' "
4 "	6"×10"×12' "	4 "	6"×10"×14' "
3 "	6"×10"×13' "	4 "	6"×10"×15' "

Nº6 12 & 6 Frogs, Split Switches.

Total Length. 85'-9¼".

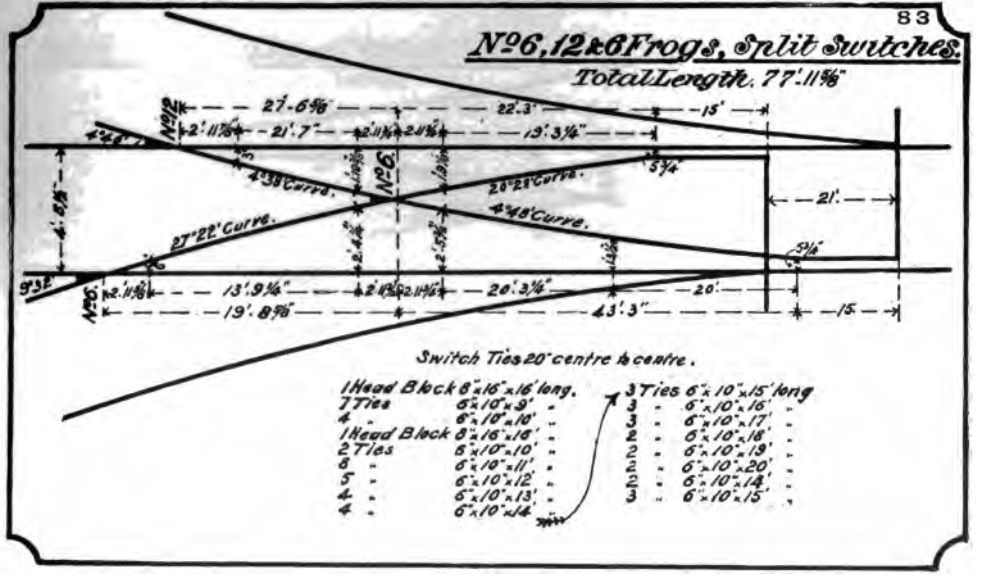


Switch Ties 20" centre to centre

1 Head Block	8"×15"×15' long	3 Ties	6"×10"×14' long
7 Ties	6"×10"×9' "	3 "	6"×10"×15' "
10 "	6"×10"×10' "	3 "	6"×10"×16' "
1 Head Block	8"×16"×16' "	3 "	6"×10"×17' "
6 Ties	6"×10"×11' "	2 "	6"×10"×18' "
6 "	6"×10"×12' "	2 "	6"×10"×19' "
5 "	6"×10"×13' "	3	6"×10"×20' "

No 6, 12 x 6 Frogs, Split Switches.

Total Length. 77'.11⅝"

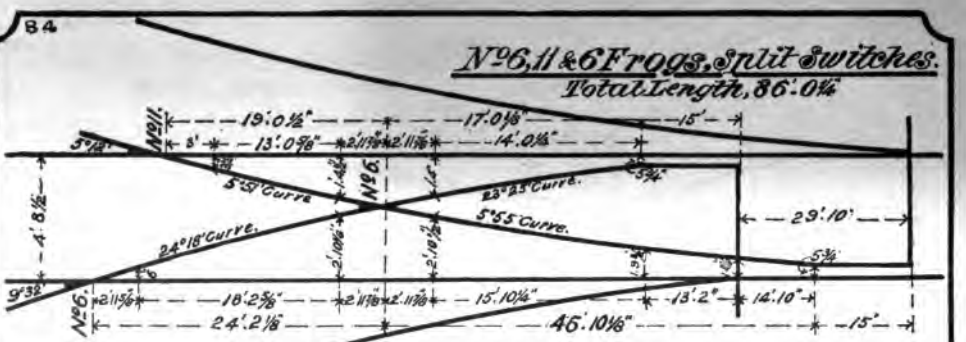


Switch Ties 20" centre to centre.

1 Head Block	8"x16"x16' long.	3 Ties	6"x10"x15' long
7 Ties	6"x10"x9' "	3 "	6"x10"x16' "
4 "	6"x10"x10' "	3 "	6"x10"x17' "
1 Head Block	8"x16"x16' "	2 "	6"x10"x18' "
2 Ties	6"x10"x10' "	2 "	6"x10"x19' "
8 "	6"x10"x11' "	2 "	6"x10"x20' "
5 "	6"x10"x12' "	2 "	6"x10"x14' "
4 "	6"x10"x13' "	3 "	6"x10"x15' "
4 "	6"x10"x14' "		

No 6, 11 & 6 Frogs, Split Switches.

Total Length, 86'.0¼

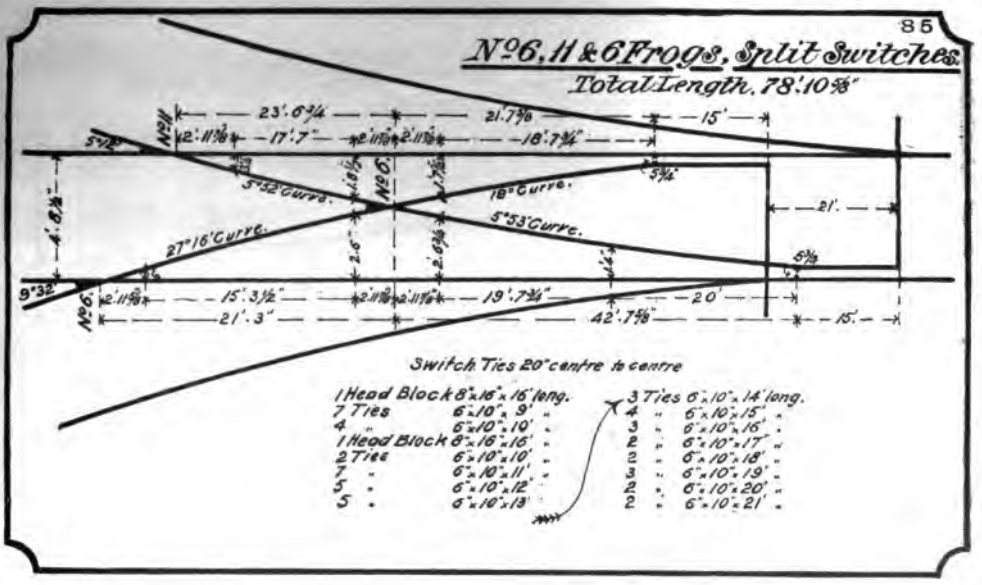


Switch Ties 20" centre to centre.

1 Head Block	8" × 16" × 16' long.	3 Ties	6" × 10" × 15' long.
7 Ties	6" × 10" × 9' "	3 "	6" × 10" × 16' "
10 "	6" × 10" × 10' "	3 "	6" × 10" × 17' "
1 Head Block	8" × 16" × 16' "	2 "	6" × 10" × 18' "
6 Ties	6" × 10" × 11' "	2 "	6" × 10" × 19' "
6 "	6" × 10" × 12' "	2 "	6" × 10" × 20' "
4 "	6" × 10" × 13' "	3 "	6" × 10" × 15 "
4 "	6" × 10" × 14' "		

No 6, 11 & 6 Frogs, Split Switches.

Total Length, 78'.10⅝"

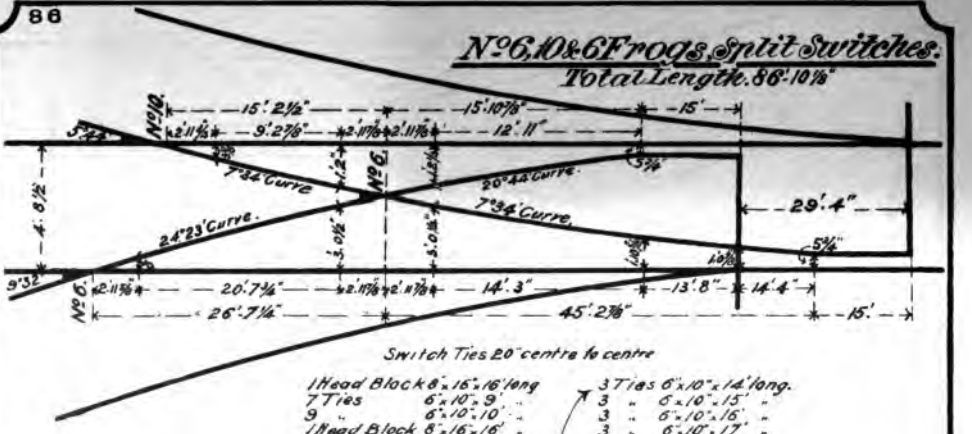


Switch Ties 20" centre to centre

1 Head Block	8"x16"x16' long.	3 Ties	6"x10"x14' long.
7 Ties	6"x10"x 9' "	4 "	6"x10"x15' "
4 "	6"x10"x10' "	3 "	6"x10"x16' "
1 Head Block	8"x16"x16' "	2 "	6"x10"x17' "
2 Ties	6"x10"x10' "	2 "	6"x10"x18' "
7 "	6"x10"x11' "	3 "	6"x10"x19' "
5 "	6"x10"x12' "	2 "	6"x10"x20' "
5 "	6"x10"x13' "	2 "	6"x10"x21' "

No 6, 10 & 6 Frogs, Split Switches.

Total Length. 86'-10⅛"

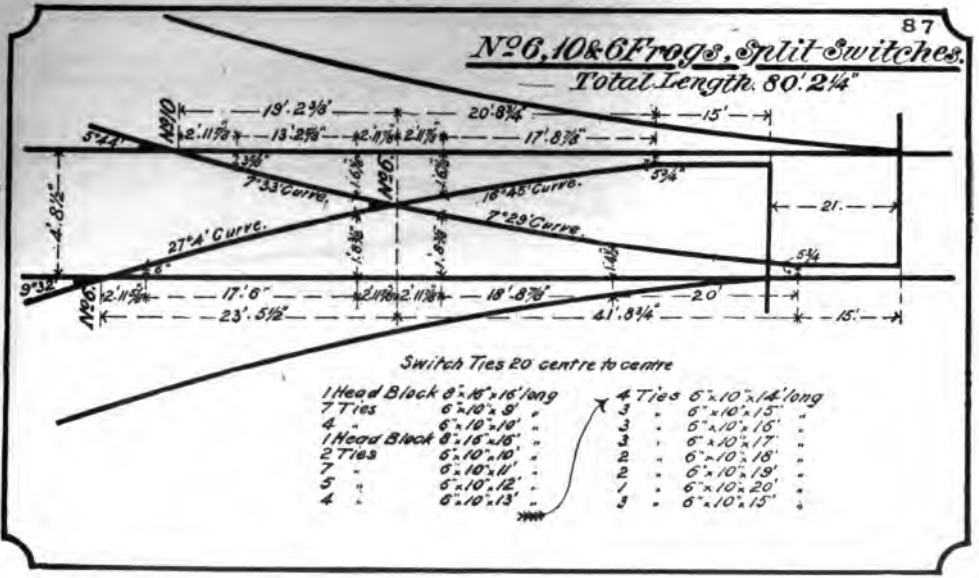


Switch Ties 20" centre to centre

1 Head Block	8" × 16" × 16' long	3 Ties	6" × 10" × 14' long.
7 Ties	6" × 10" × 9' "	3 "	6" × 10" × 15' "
9 "	6" × 10" × 10' "	3 "	6" × 10" × 16' "
1 Head Block	8" × 16" × 16' "	3 "	6" × 10" × 17' "
6 Ties	6" × 10" × 11' "	3 "	6" × 10" × 18' "
6 "	6" × 10" × 12' "	4 "	6" × 10" × 14' "
4 "	6" × 10" × 13' "	3 "	6" × 10" × 15' "

No. 6, 10 & 6 Frogs. Split Switches.

Total Length 80'. 2¼"



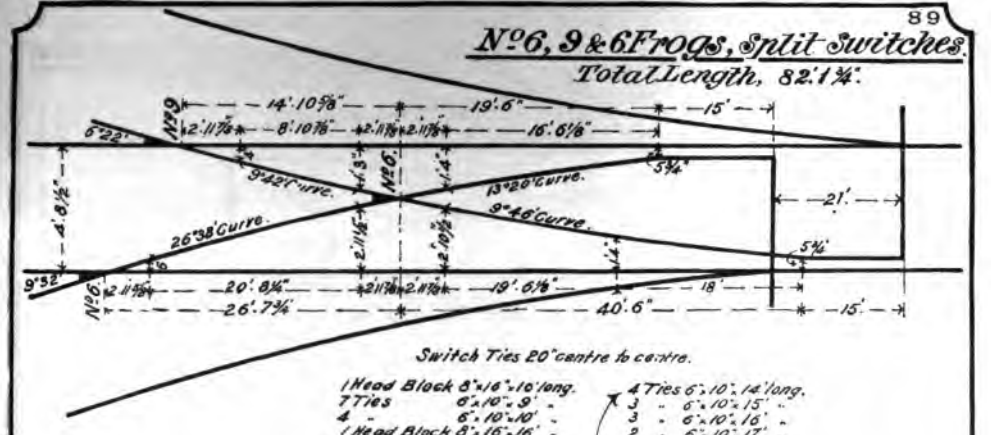
Switch Ties 20 centre to centre

1 Head Block	8" × 15" × 16' long		4 Ties	6" × 10" × 14' long	
7 Ties	6" × 10" × 9'	"	3	6" × 10" × 15'	"
4 "	6" × 10" × 10'	"	3	6" × 10" × 15'	"
1 Head Block	8" × 15" × 16'	"	3	6" × 10" × 17'	"
2 Ties	6" × 10" × 10'	"	2	6" × 10" × 18'	"
7 "	6" × 10" × 11'	"	2	6" × 10" × 19'	"
5 "	6" × 10" × 12'	"	1	6" × 10" × 20'	"
4 "	6" × 10" × 13'	"	3	6" × 10" × 15'	"

No. 6, 9 & 6 Frogs, Split Switches.
Total Length. 87'-9¾".

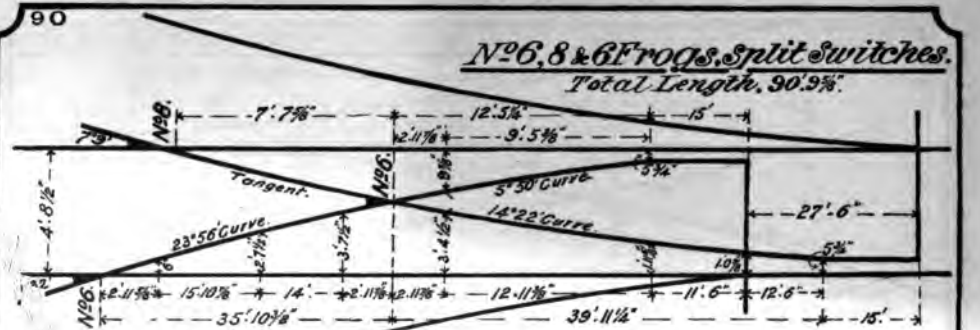
No. 6, 9 & 6 Frogs, Split Switches.

Total Length, 82'.1¾".



No 6, 8 & 6F rogs. Split Switches.

Total Length. 90'.9⅜".

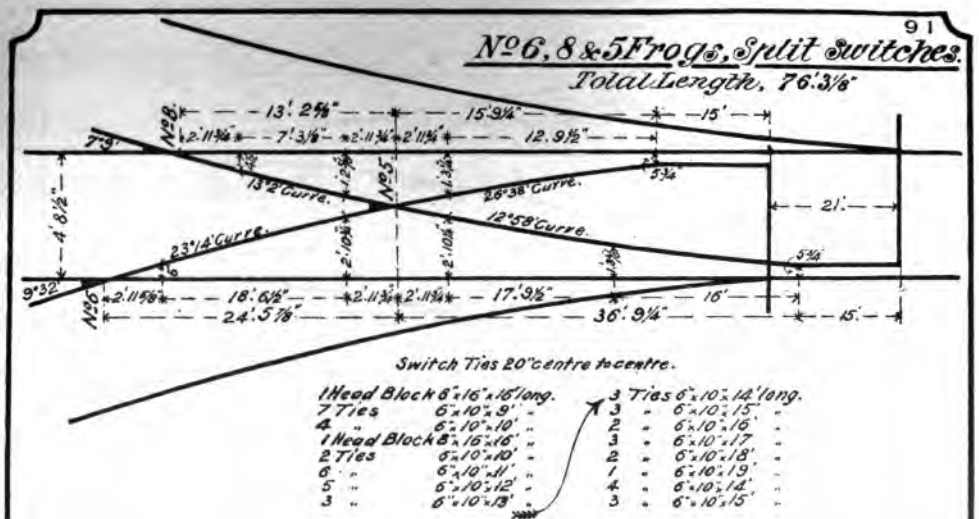


Switch Ties 20" centre to centre.

1 Head Block	8" × 16" × 16' long.	3 Ties	6" × 10" × 15' long.
7 Ties	6" × 10" × 9' "	3 "	6" × 10" × 16' "
8 "	6" × 10" × 10' "	2 "	6" × 10" × 17' "
1 Head Block	8" × 16" × 16' "	5 "	6" × 10" × 12' "
5 Ties	6" × 10" × 11' "	5 "	6" × 10" × 13' "
5 "	6" × 10" × 12' "	3 "	6" × 10" × 14' "
4 "	6" × 10" × 13' "	3 "	6" × 10" × 15' "
3 "	6" × 10" × 14' "		

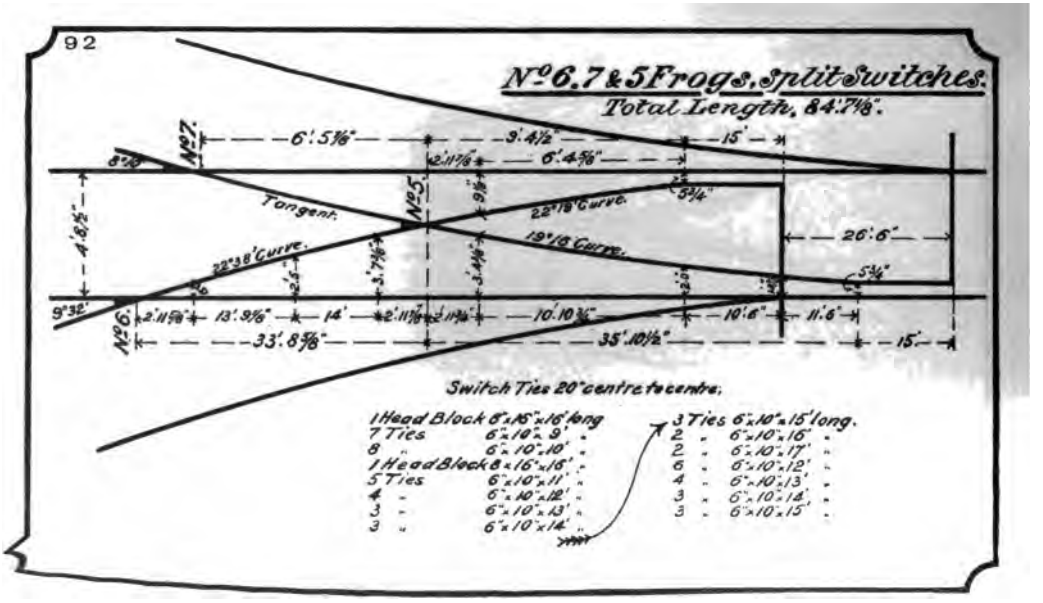
No 6, 8 & 5 Frogs, Split Switches.

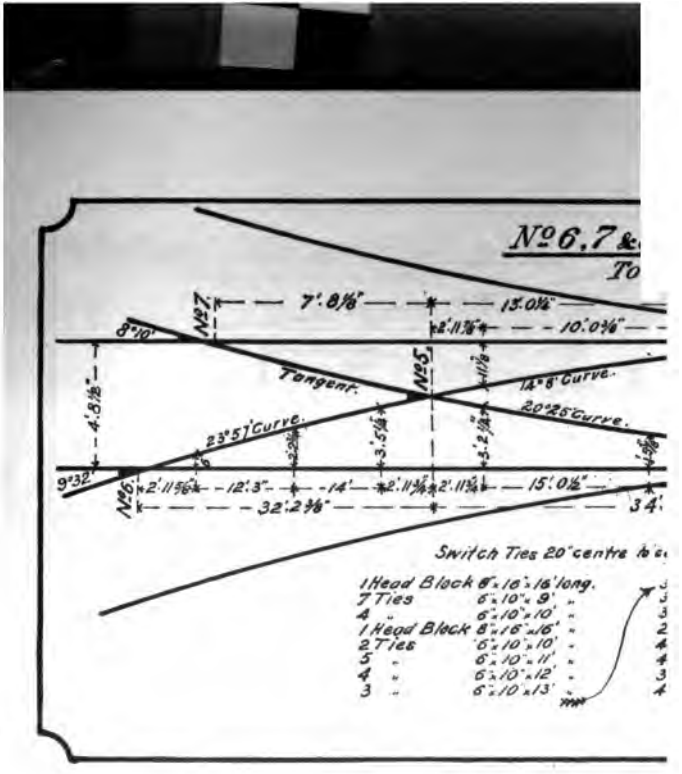
Total Length, 76'3⅛"

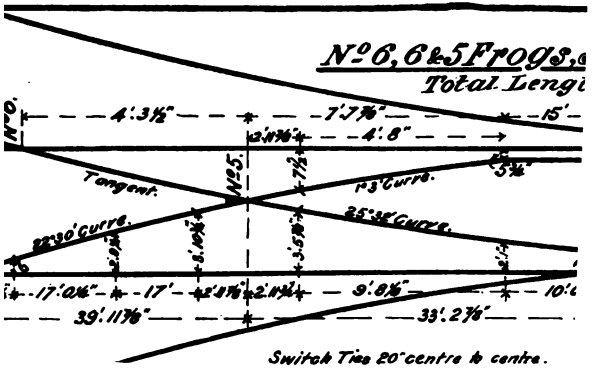


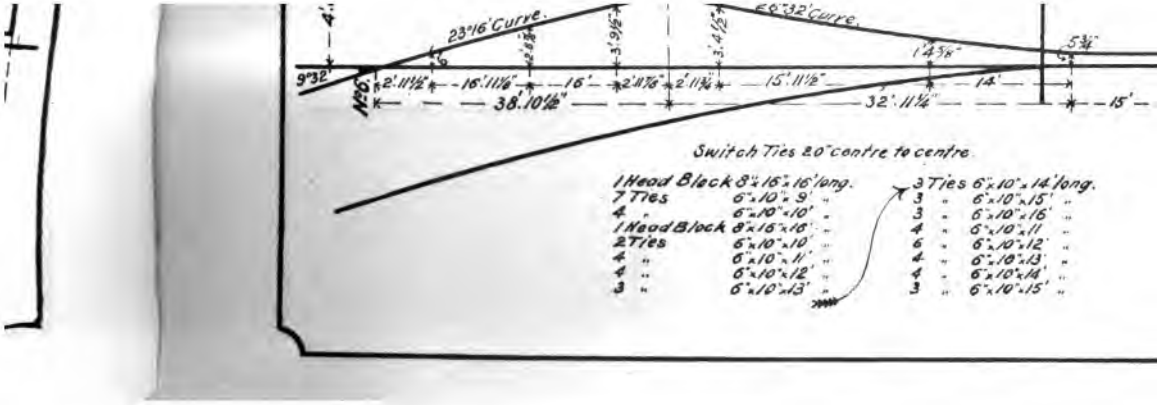
Switch Ties 20" centre to centre.

1 Head Block	6"×16"×16' long.	3 Ties	6"×10"×14' long.
7 Ties	6"×10"×9' "	3 "	6"×10"×15' "
4 "	6"×10"×10' "	2 "	6"×10"×16' "
1 Head Block	8"×16"×16' "	3 "	6"×10"×17' "
2 Ties	6"×10"×10' "	2 "	6"×10"×18' "
6 "	6"×10"×11' "	1 "	6"×10"×19' "
5 "	6"×10"×12' "	4 "	6"×10"×14' "
3 "	6"×10"×13' "	3 "	6"×10"×15' "

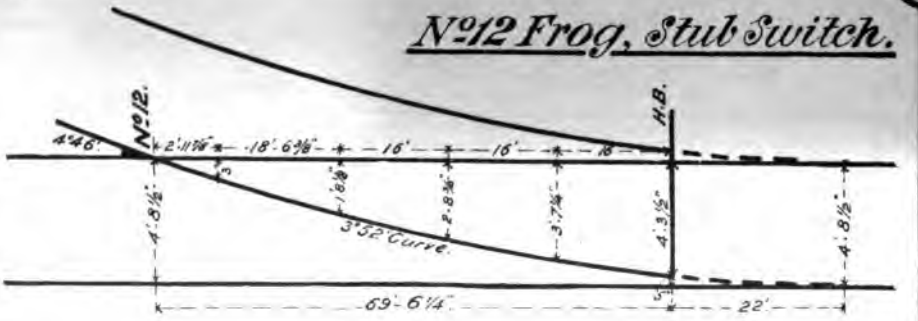

No. 6.7 & 5 Frogs. Split Switches.
Total Length, 84'.7⅛".
No.7
No.5
No.6
6'.5⅛"
3'.4½"
15'
6'.4⅝"
2'.11⅞"
8°.10'
4'.8½"
Tangent.
22°.18' Curve.
19°.18' Curve.
22°.38' Curve.
9°.32'
26'.6"
5¼"
3¾"
9⅛"
13'.9⅛"
14'
10'.10¾"
10'.6"
11'.6"
33'.8⅞"
35'.10½"
Switch Ties 20" centre to centre.
1 Head Block 8"x15"x16' long
7 Ties 6"x10"x9' "
8 " 6"x10"x10' "
1 Head Block 8"x16"x16' "
5 Ties 6"x10"x11' "
4 " 6"x10"x12' "
3 " 6"x10"x13' "
3 " 6"x10"x14' "
3 Ties 6"x10"x15' long.
2 " 6"x10"x16' "
2 " 6"x10"x17' "
6 " 6"x10"x12' "
4 " 6"x10"x13' "
3 " 6"x10"x14' "
3 " 6"x10"x15' "


No 6, 7 &
To
No 7
No 5
No 6
7'. 8 1/8"
15'. 0 1/2"
2'. 11 5/8"
10'. 0 3/8"
8°10'
Tangent.
14°8' Curve.
20°25' Curve.
23°5' Curve.
4'. 8 1/8"
9°32'
2'. 11 5/8"
12'. 3"
14'
2'. 11 3/8"
2'. 11 3/8"
15'. 0 1/2"
32'. 2 3/8"
34'
Switch Ties 20" centre to c
1 Head Block 8" x 16" x 16' long.
7 Ties 6" x 10" x 9' "
4 " 6" x 10" x 10' "
1 Head Block 8" x 16" x 16' "
2 Ties 6" x 10" x 10' "
5 " 6" x 10" x 11' "
4 " 6" x 10" x 12' "
3 " 6" x 10" x 13' "


Nº6, 6 & 5 Frogs,
Total Lengi
4'-3½"
7'-7⅞"
15'-
4'-8"
Nº5.
Tangent.
1-3 Curve.
25°-14' Curve.
22°-30' Curve.
17'-0¼"
17'-
9'-8⅛"
10'-
39'-11⅞"
33'-2⅞"
Switch Ties 20" centre to centre.


4'
23°16' Curve.
3'9½"
3'4½"
69°32' Curve.
1'4⅝"
5¾"
9°32'
11°36'
2'11½"
16'11⅛"
16'
2'11⅛"
2'11¾"
15'11½"
14'
38'10½"
32'11¼"
15'
Switch Ties 20" centre to centre.
1 Head Block 8"x16"x16' long.
7 Ties 6"x10"x9' "
4 " 6"x10"x10' "
1 Head Block 8"x16"x16' "
2 Ties 6"x10"x10' "
4 " 6"x10"x11' "
4 " 6"x10"x12' "
3 " 6"x10"x13' "
3 Ties 6"x10"x14' long.
3 " 6"x10"x15' "
3 " 6"x10"x16' "
4 " 6"x10"x11 "
6 " 6"x10"x12' "
4 " 6"x10"x13' "
4 " 6"x10"x14' "
3 " 6"x10"x15' "

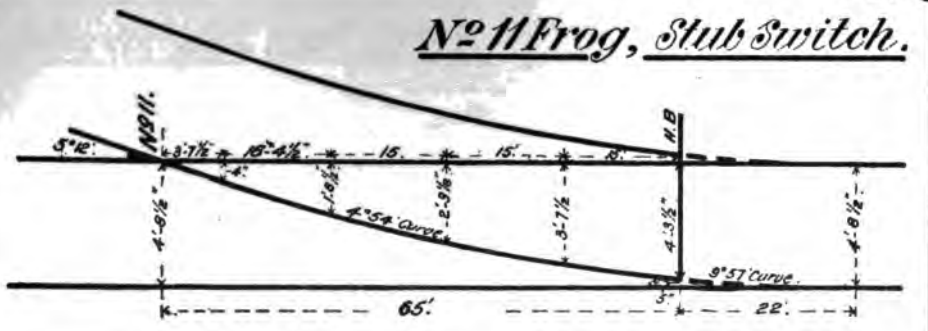
No 12 Frog, Stub Switch.



Switch Ties 20" centre to centre.

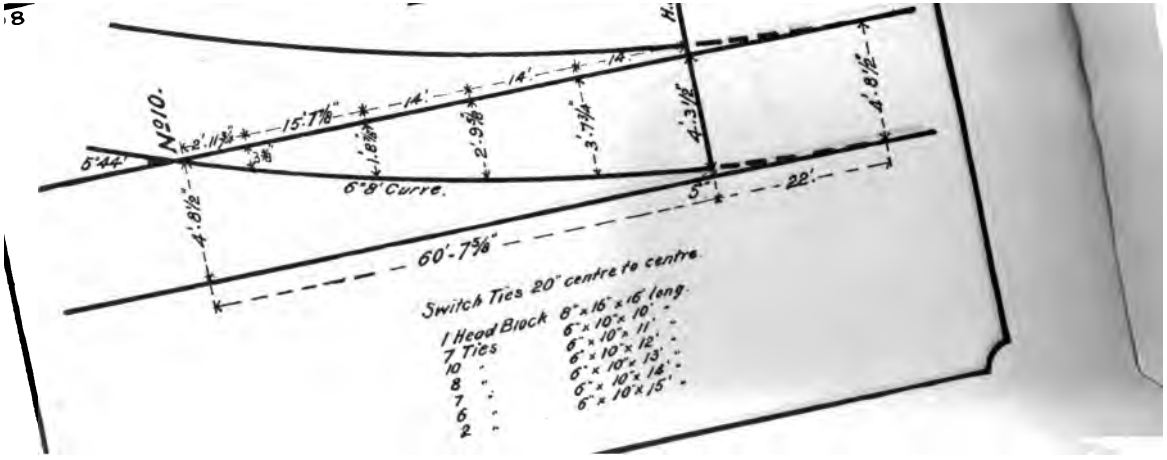
1	Head Block	8" × 16" × 16' long
8	Ties	6" × 10" × 10' "
11	"	6" × 10" × 11' "
9	"	6" × 10" × 12' "
8	"	6" × 10" × 13' "
6	"	6" × 10" × 14' "
3	"	6" × 10" × 15' "

No 11 Frog, Stub Switch.

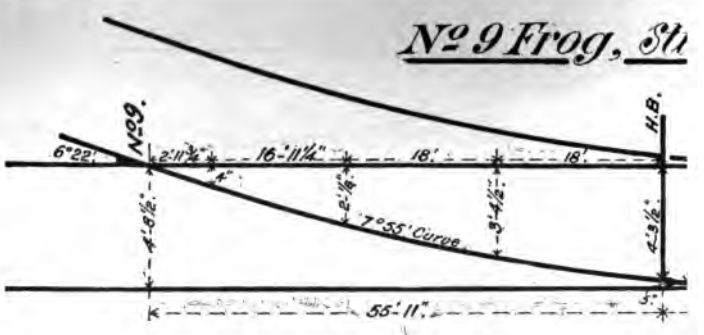


Switch Ties 20" centre to centre

1 Head Block	8" × 16" - 16' long
10 Ties	6" × 10" - 10' "
10 "	6" × 10" - 11' "
9 "	6" × 10" - 12' "
6 "	6" × 10" - 13' "
7 "	6" × 10" - 14' "


No 10.
5'44'
6"8' Curve.
4'8½"
60'-7⅝"
22'
14'
Switch Ties 20" centre to centre.
1 Head Block 8" x 16" x 16' long
7 Ties 6" x 10" x 10' "
10 " 6" x 10" x 11' "
8 " 6" x 10" x 12' "
7 " 6" x 10" x 13' "
6 " 6" x 10" x 14' "
2 " 6" x 10" x 15' "

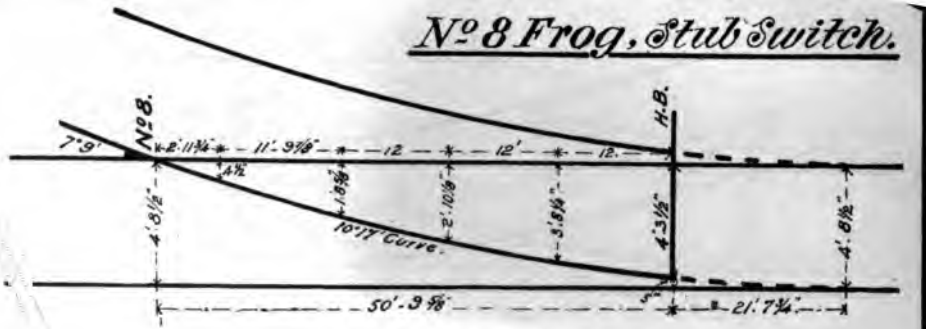
No 9 Frog, St



Switch Ties 20" centre to centre.

1	Head Block	8" × 16" - 16' long.
8	Ties	6" × 10" - 10' "
9	"	6" × 10" - 11' "
7	"	6" × 10" - 12' "
6	"	6" × 10" - 13' "
6	"	6" × 10" 14'

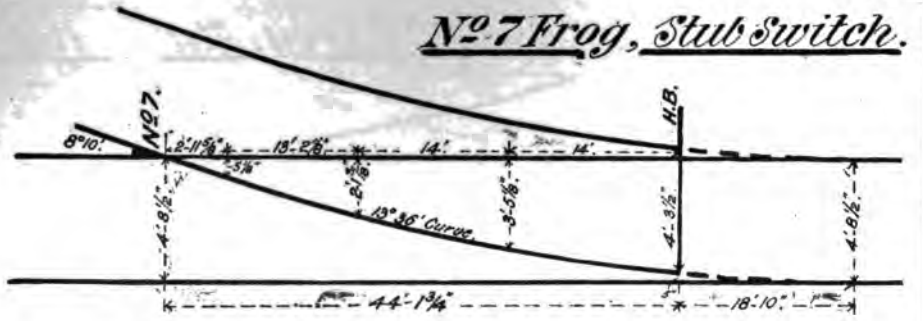
No 8 Frog, Stub Switch.



Switch Ties 20" centre to centre.

1 Head Block	8" x 16" x 16' long.
5 Ties	6" x 10" x 10' "
8 "	6" x 10" x 11' "
7 "	6" x 10" x 12' "
6 "	6" x 10" x 13' "
4 "	6" x 10" x 14' "
3 "	6" x 10" x 15' "

No. 7 Frog, Stub Switch.

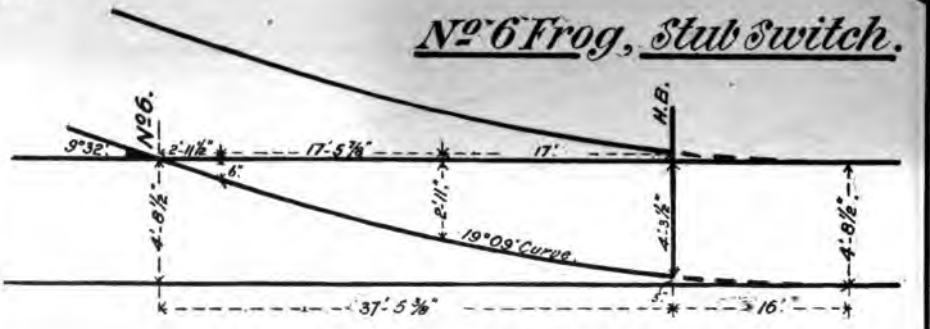


Switch Ties 20" centre to centre.

1	Head Block	8" x 16" - 16' long
6	Ties	8" x 10" - 10' "
7	"	8" x 10" - 11' "
6	"	8" x 10" - 12' "
4	"	8" x 10" - 13' "
5	"	8" x 10" - 14' "
2	"	8" x 10" - 15' "

1·02.

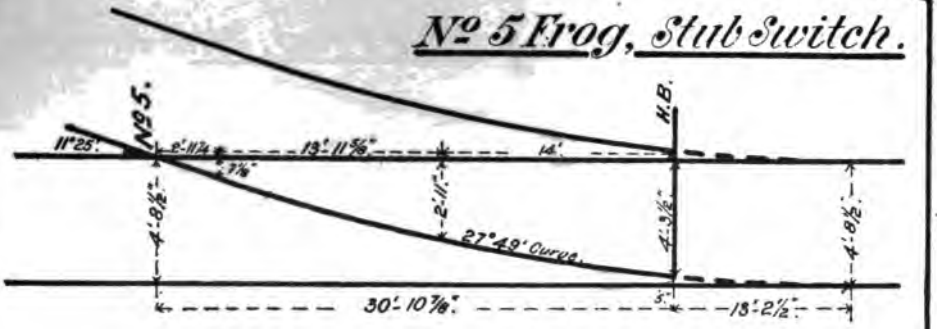
No 6 Frog, Stub Switch.



Switch Ties 20" centre to centre.

1 Head Block	8" × 16"	16' long.
5 Ties	6" × 10"	10' "
6 "	6" × 10"	11' "
5 "	6" × 10"	12' "
4 "	6" × 10"	13' "
4 "	6" × 10"	14' "
2 "	6" × 10"	15' "

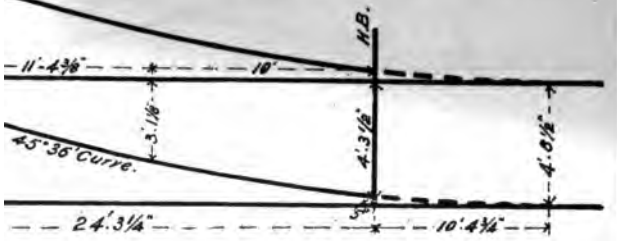
No 5 Frog, Stub Switch.



Switch Ties 20" centre to centre.

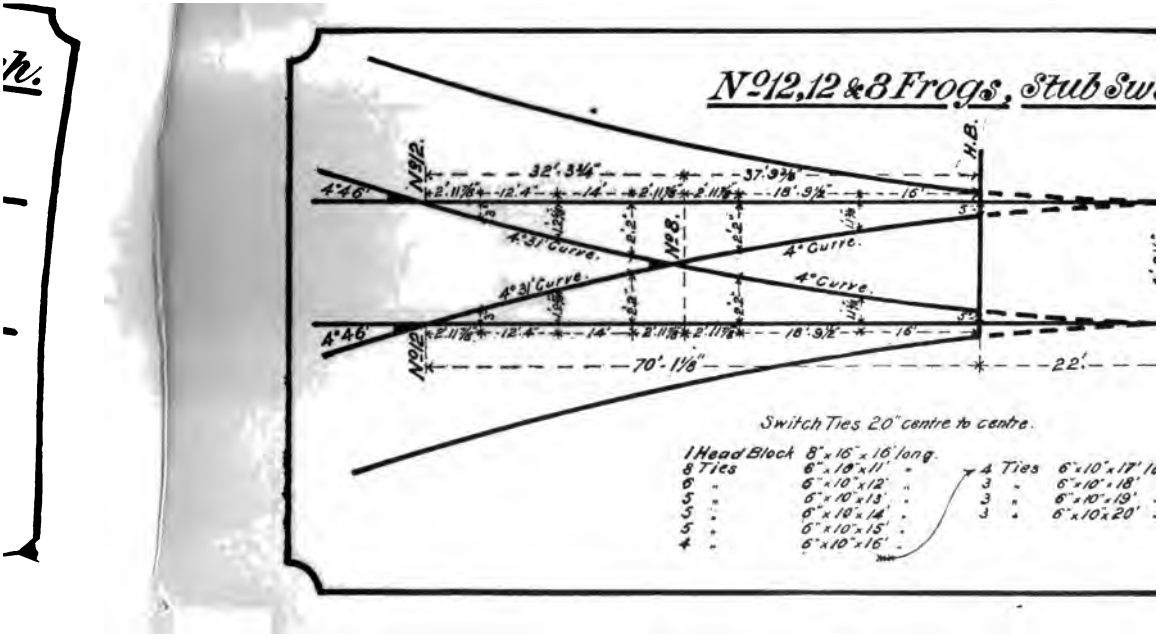
1 Head Block	8" × 16" - 16' long.
6 Ties	6" × 10" - 10' "
4 "	6" × 10" - 11' "
4 "	6" × 10" - 12' "
3 "	6" × 10" - 13' "
3 "	6" × 10" - 14' "
2 "	6" × 10" - 15' "

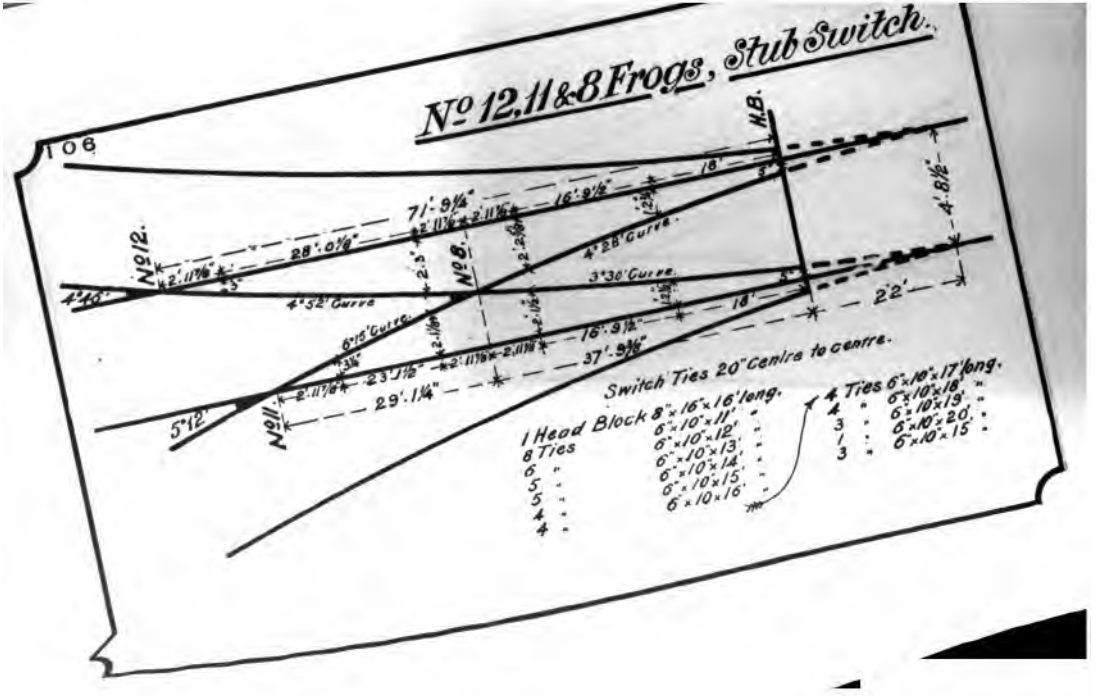
No 4 Frog, Stub Switch.



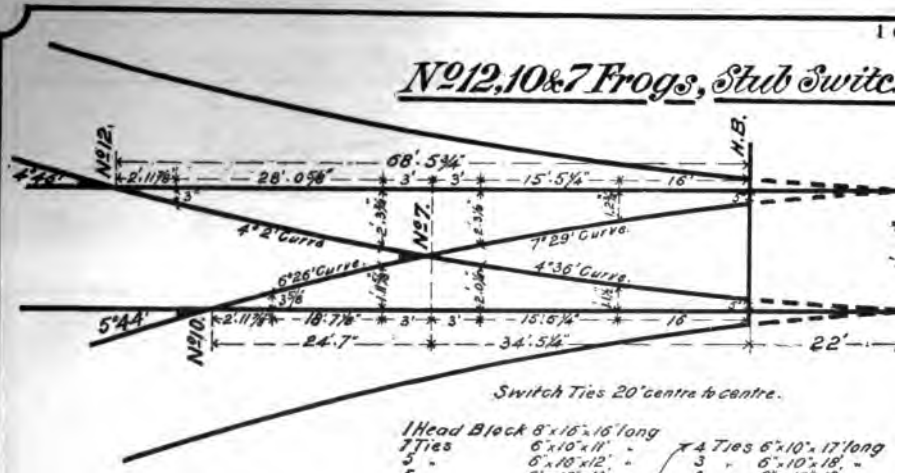
Switch Ties 20" centre to centre.

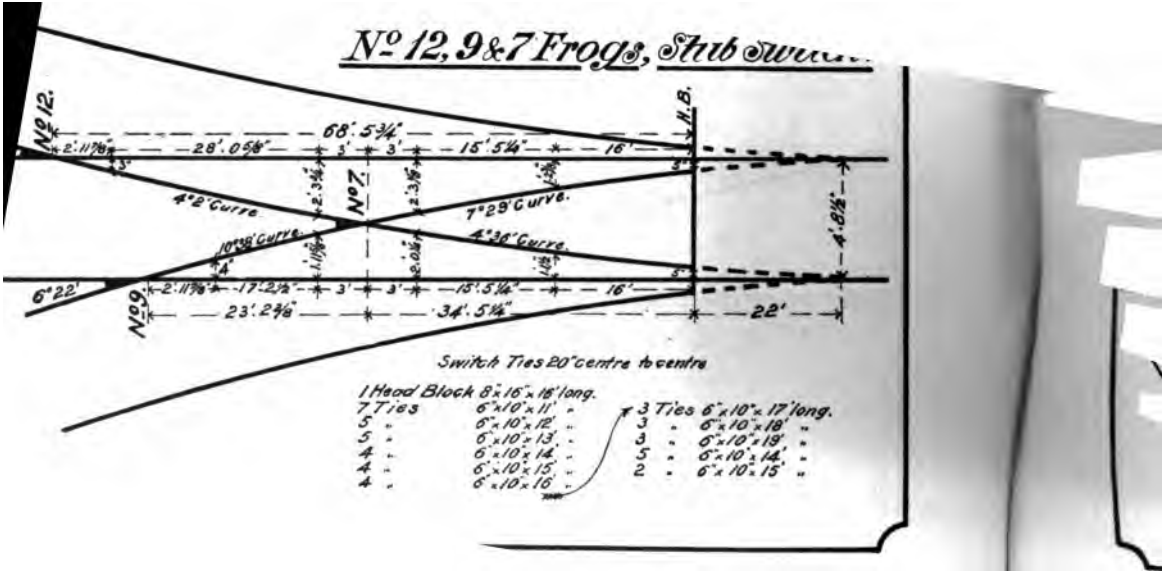
1 Head Block	8" x 16" x 16' long.
2 Ties	6" x 10" x 10' "
4 "	6" x 10" x 11' "
3 "	6" x 10" x 12' "
2 "	6" x 10" x 13' "
3 "	6" x 10" x 14' "
3 "	6" x 10" x 15' "
1 "	6" x 10" x 16' "

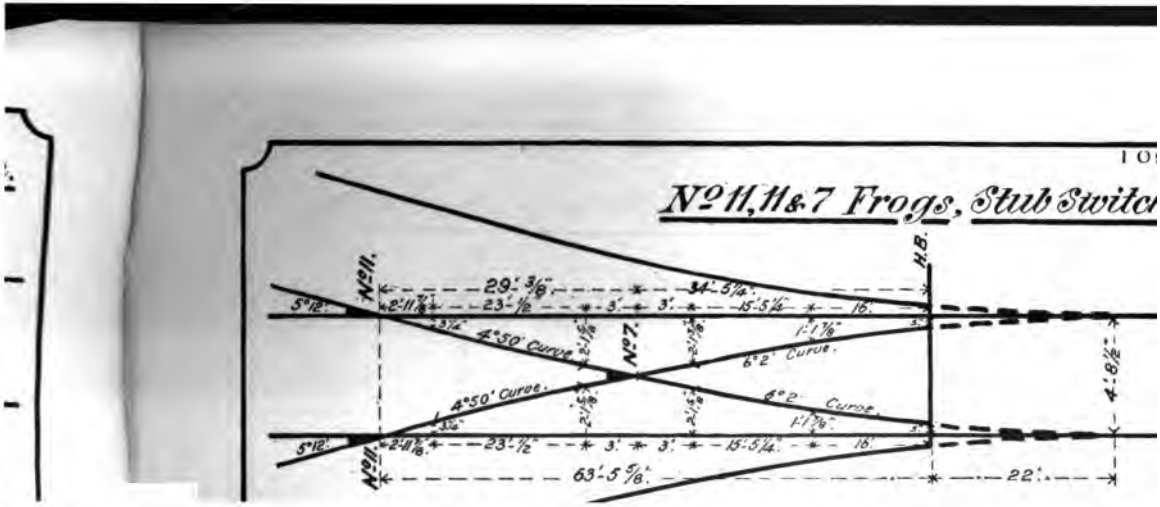

No12,12 & 8 Frogs, Stub Sw
No12.
No8.
H.B.
32'-3¼"
37'-3⅜"
4°46'
2'-11⅞"
12'-4"
14'
18'-9½"
16'
4°31' Curve.
4° Curve.
70'-1⅛"
22'
Switch Ties 20" centre to centre.
1 Head Block 8"x16"x16' long.
8 Ties 6"x10"x11'
6"x10"x12'
6"x10"x13'
6"x10"x14'
6"x10"x15'
6"x10"x16'
4 Ties
3
3
3
6"x10"x17'
6"x10"x18'
6"x10"x19'
6"x10"x20'


No 12,11&8 Frogs, Stub Switch.
106
M.B.
No 12.
No 8.
No 11.
71'-9¼"
28'-0⅛"
16'-9½"
18'
4'-8½"
22'
4°28' Curve.
3°30' Curve.
4°52' Curve.
6°15' Curve.
37'-9⅜"
29'-1¼"
23'-1½"
16'-9½"
5°12'
Switch Ties 20" Centre to centre.
1 Head Block 8"×16"×16' long.
8 Ties 6"×10"×11' "
6 " 6"×10"×12' "
5 " 6"×10"×13' "
5 " 6"×10"×14' "
4 " 6"×10"×15' "
4 " 6"×10"×16' "
4 Ties 6"×10"×17' long.
4 " 6"×10"×18' "
3 " 6"×10"×19' "
1 " 6"×10"×20' "
3 " 6"×10"×15' "

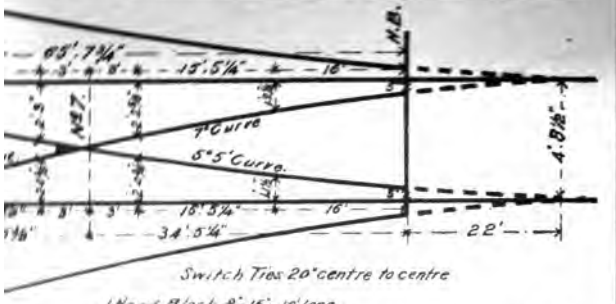
No 12, 10 & 7 Frogs, Stub Switc




No 12, 9 & 7 Frogs, Stub Switches
No 12.
No 7.
No 9.
H.B.
68'. 5¾"
28'. 0⅝"
15'. 5¼"
16'
4°2' Curve.
7°29' Curve.
10°38' Curve.
4°36' Curve.
4'. 8½"
6°22'
17'. 2½"
23'. 2⅜"
34'. 5½"
22'
Switch Ties 20" centre to centre
1 Head Block 8"x16"x18' long.
7 Ties 6"x10"x11' "
5 " 6"x10"x12' "
5 " 6"x10"x13' "
4 " 6"x10"x14' "
4 " 6"x10"x15' "
4 " 6"x10"x16' "
3 Ties 6"x10"x17' long.
3 " 6"x10"x18' "
3 " 6"x10"x19' "
5 " 6"x10"x14' "
2 " 6"x10"x15' "


No 11, 11 & 7 Frogs, Stub Switch
No 11.
No 7.
H.B.
29'-3/8"
34'-5/16"
23'-1/2"
3'
3'
15'-5/16"
16'
5°12'
2'-11 7/16"
3 1/4"
4°50' Curve.
6°2' Curve.
1'-1 7/16"
2'-1 5/8"
4'-8 1/2"
63'-5 5/8"
22'

No 11, 10 & 7 Frogs, Stub Switch.



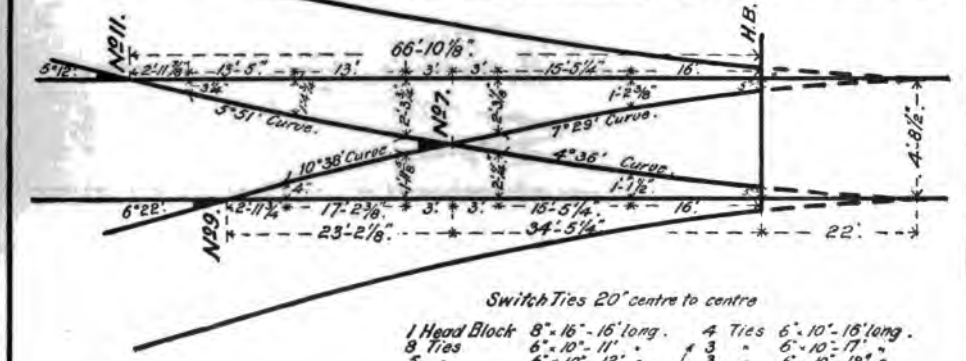
Switch Ties 20" centre to centre

1 Head Block 8"x16"x16' long

7	Ties	6"x10"x11'	"
6	"	6"x10"x12'	"
4	"	6"x10"x13'	"
4	"	6"x10"x14'	"
3	"	6"x10"x15'	"
1	"	6"x10"x16'	"
1	"	6"x10"x17'	"

3	Ties	6"x10"x18'	long
3	"	6"x10"x19'	"
1	"	6"x10"x20'	"
2	"	6"x10"x14'	"
1	"	6"x10"x15'	"

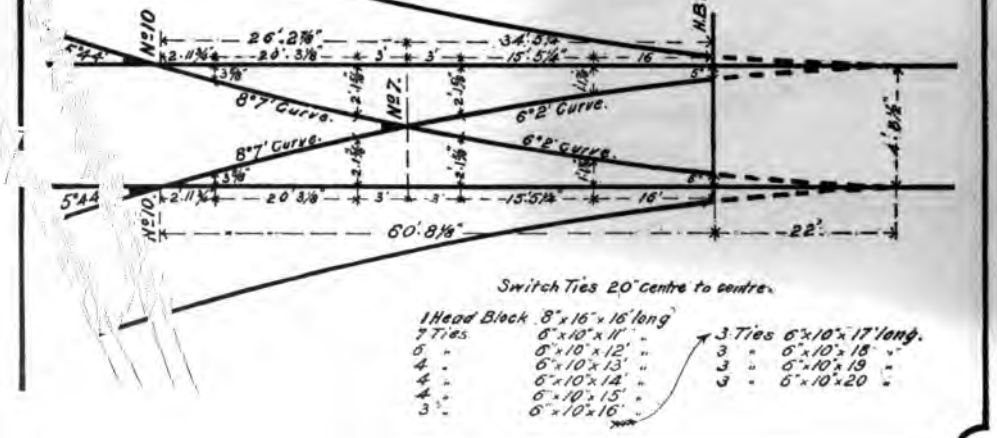
No 11, 9 & 7 Frogs, Stub Switch.



Switch Ties 20" centre to centre

1 Head Block	8" × 16" - 15' long.	4	Ties	6" × 10" - 16' long.
8 Ties	6" × 10" - 11' "	3	"	6" × 10" - 17' "
5 "	6" × 10" - 12' "	3	"	6" × 10" - 18' "
4 "	6" × 10" - 13' "	3	"	6" × 10" - 19' "
4 "	6" × 10" - 14' "	4	"	6" × 10" - 14' "
4 "	6" × 10" - 15' "	2	"	6" × 10" - 15' "

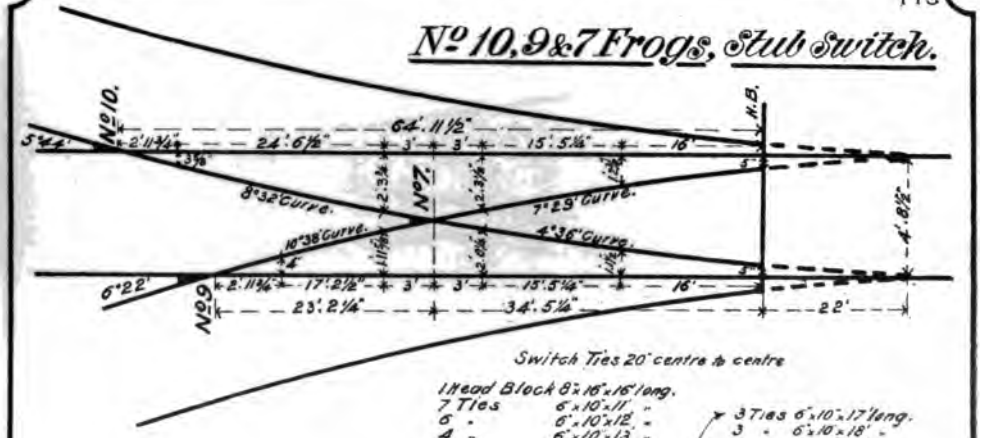
Nº10, 10 & 7 Frogs. Stub Switch.

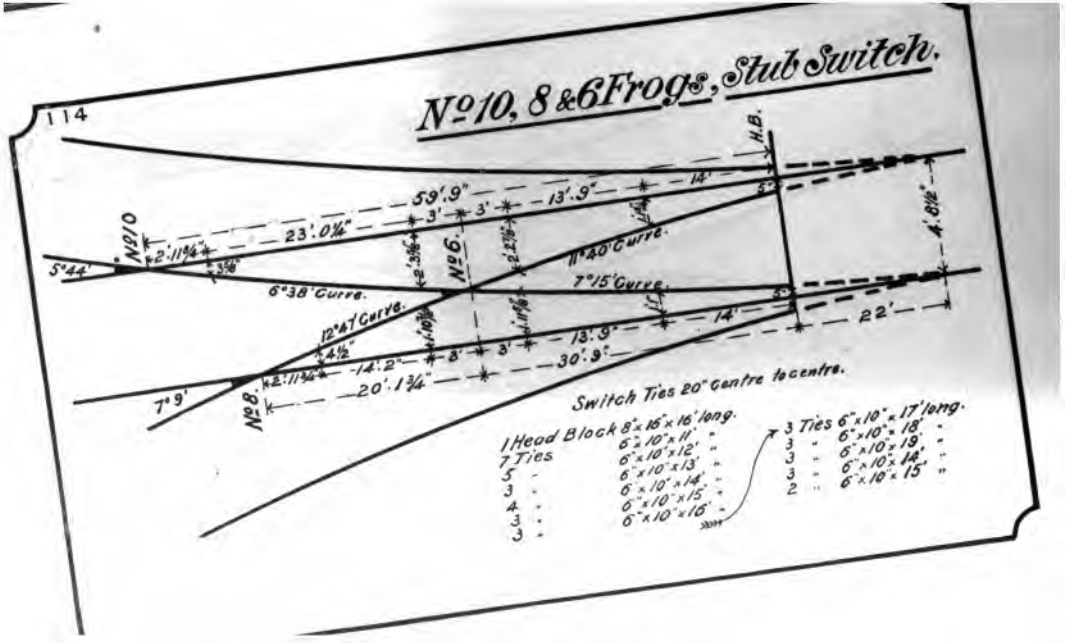


Switch Ties 20" centre to centre.

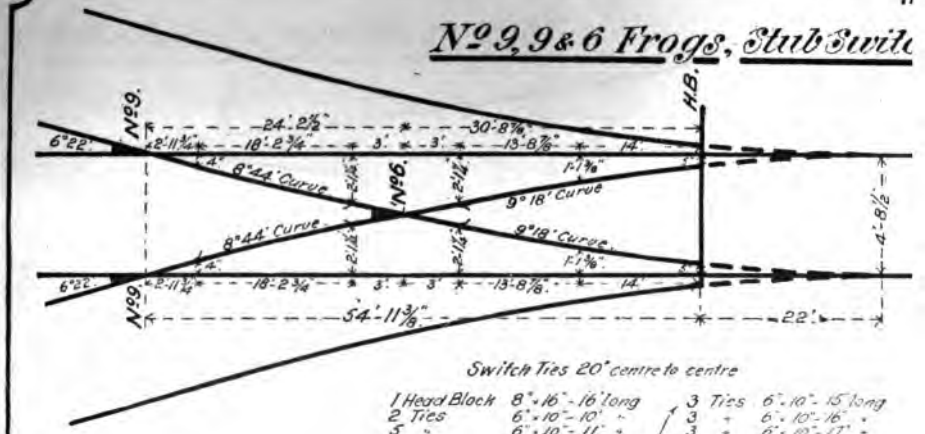
1 Head Block	8"x16"x16' long	
7 Ties.	6"x10"x11' "	
6 "	6"x10"x12' "	
4 "	6"x10"x13' "	
4 "	6"x10"x14' "	
4 "	6"x10"x15' "	
3 "	6"x10"x16' "	
3 Ties	6"x10"x17' long.	
3 "	6"x10"x18' "	
3 "	6"x10"x19' "	
3 "	6"x10"x20' "	

No 10, 9 & 7 Frogs, Stub Switch.




No 10, 8 & 6 Frogs, Stub Switch.
H.B.
No 10
No 8
No 6
59'.9"
23'.0¼"
14'
13'.9"
3'
5°44'
6°38' Curve.
11°40' Curve.
7°15' Curve.
12°51' Curve.
7°9'
14'.2"
20'.1¾"
30'.9"
22'
4'.8½"
Switch Ties 20" Centre to centre.
1 Head Block 8"x 15"x 16' long.
7 Ties 6"x 10"x 11' "
5 " 6"x 10"x 12' "
3 " 6"x 10"x 13' "
4 " 6"x 10"x 14' "
3 " 6"x 10"x 15' "
3 " 6"x 10"x 16' "
3 Ties 6"x 10"x 17' long.
3 " 6"x 10"x 18' "
3 " 6"x 10"x 19' "
3 " 6"x 10"x 14' "
2 " 6"x 10"x 15' "

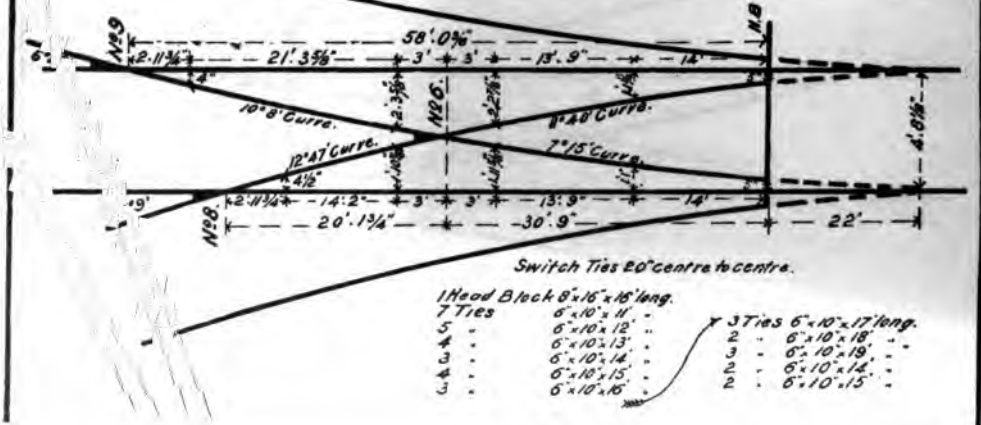
No 2, 9 & 6 Frogs, Stub Switc

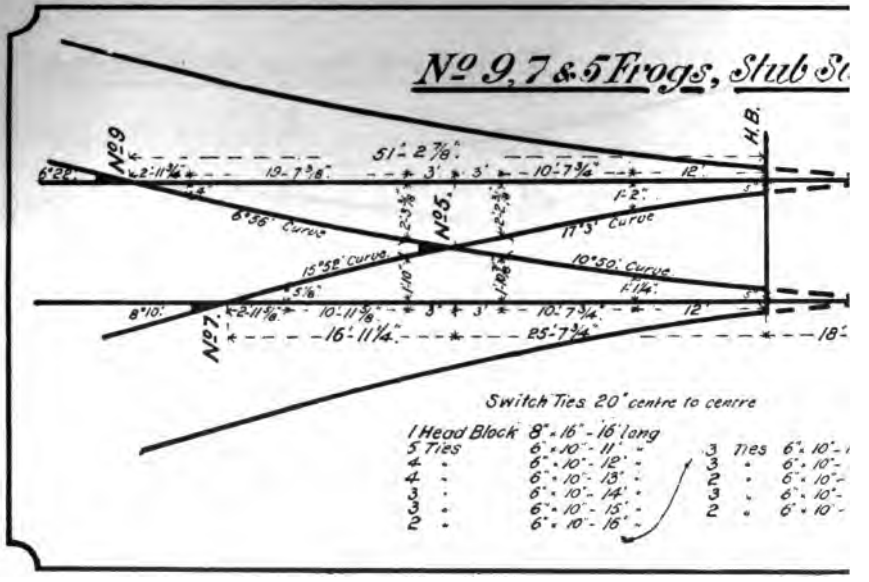


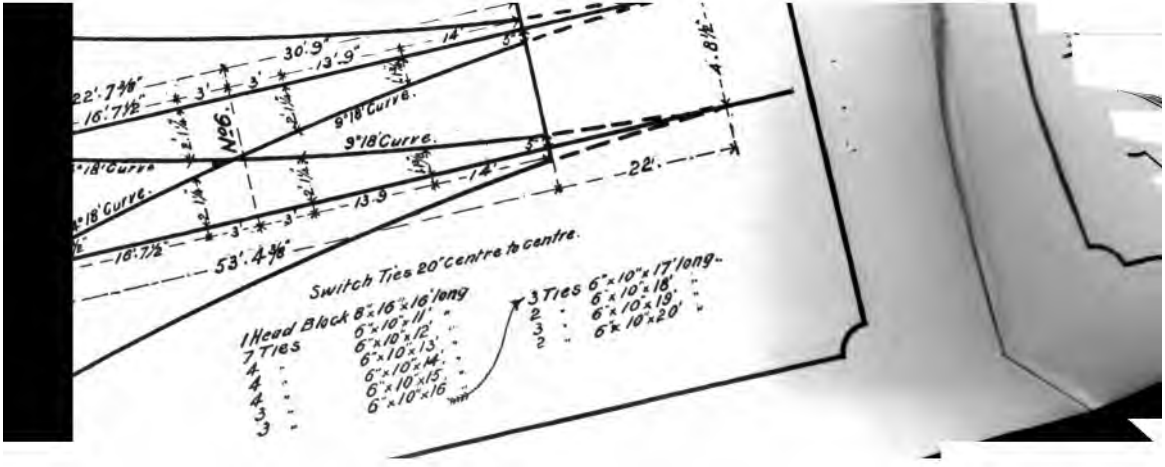
Switch Ties 20" centre to centre

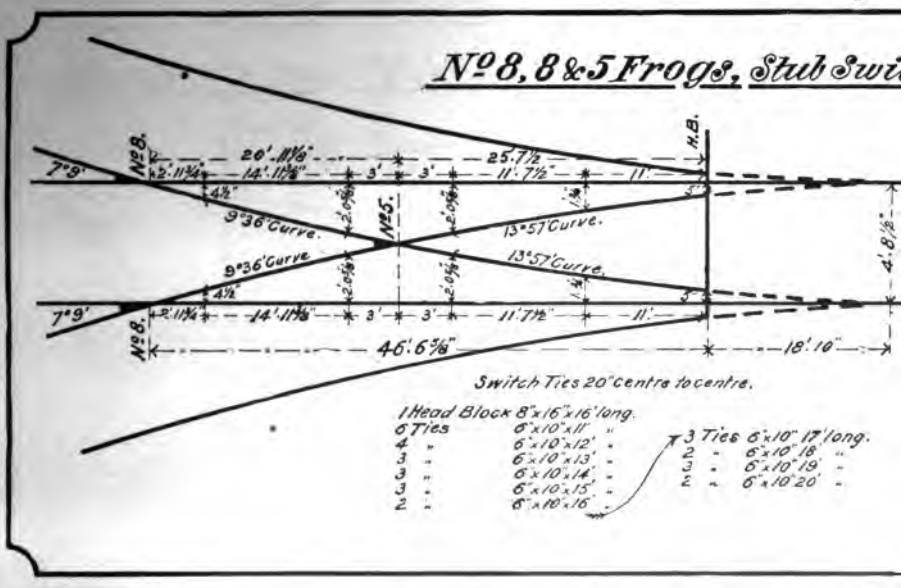
1 Head Block	8" × 16" - 16' long		3	Ties	6" × 10" - 15' long
2 Ties	6" × 10" - 10' "		3	"	6" × 10" - 16' "
5 "	6" × 10" - 11' "		3	"	6" × 10" - 17' "
5 "	6" × 10" - 12' "		3	"	6" × 10" - 18' "
3 "	6" × 10" - 13' "		3	"	6" × 10" - 19' "
4 "	6" × 10" - 14' "		3	"	6" × 10" - 20' "

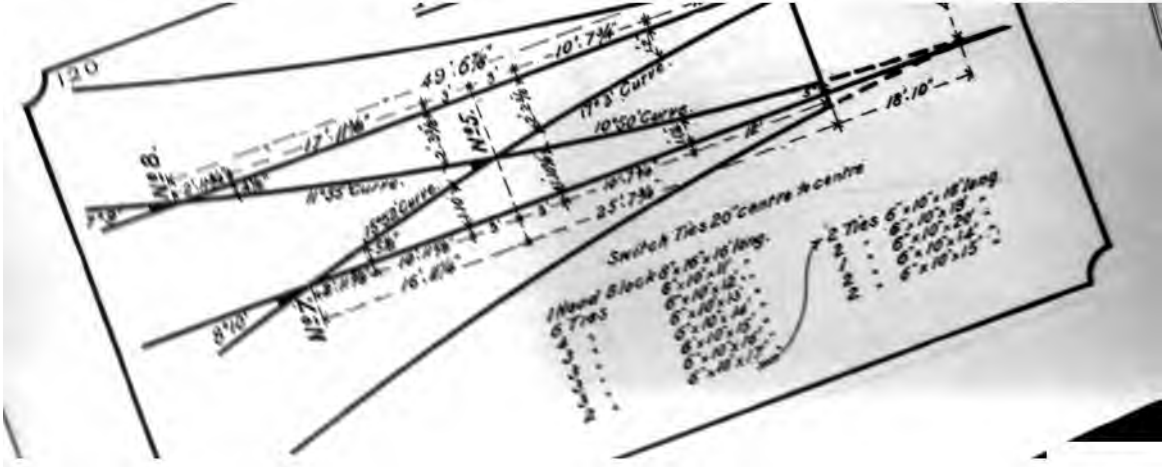
No. 9, 8 & 6 Frogs, Stub Switch.

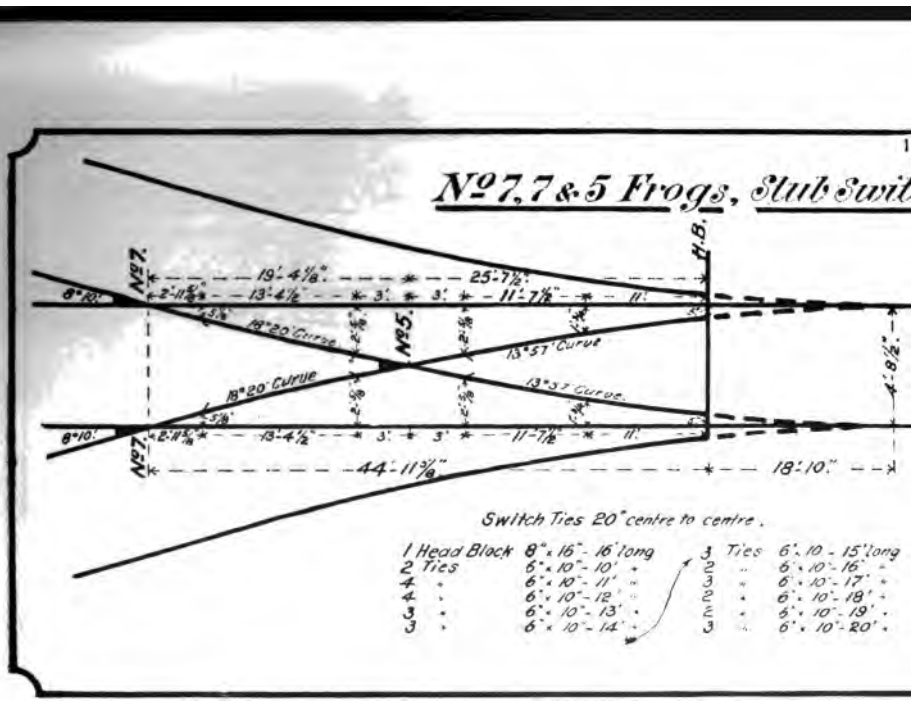



No 9, 7 & 5 Frogs, Stub S
H.B.
No 9
No 5
No 7
51'-2 7/8"
19'-7 3/8"
3'
3'
10'-7 3/4"
12'
6°22'
2'-11 3/4"
6°36' Curve
11°3' Curve
15°58' Curve
10°50' Curve
8°10'
2'-11 5/8"
10'-11 5/8"
10'-7 3/4"
16'-11 1/4"
25'-7 3/4"
18'
Switch Ties 20" centre to centre
1 Head Block 8" x 16" - 16' long
5 Ties 6" x 10" - 11' "
4 " 6" x 10" - 12' "
4 " 6" x 10" - 13' "
4 " 6" x 10" - 14' "
5 " 6" x 10" - 15' "
5 " 6" x 10" - 16' "
3 Ties 6" x 10" -
3 " 6" x 10" -
3 " 6" x 10" -
2 " 6" x 10" -

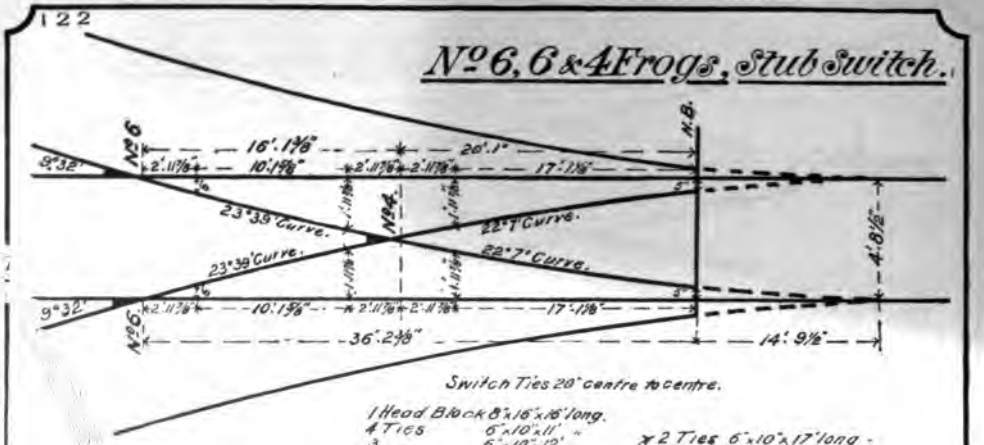

30'.9"
13'.9"
14"
22'.7½"
16'.7½"
3'
9°18' Curve.
9°18' Curve.
9°18' Curve.
9°18' Curve.
22'.
14'
13.9
53'.4½"
Switch Ties 20" centre to centre.
1 Head Block 8"x16"x16' long
7 Ties
4 "
4 "
4 "
3 "
3 "
6"x10"x11' "
6"x10"x12' "
6"x10"x13' "
6"x10"x14' "
6"x10"x15' "
6"x10"x16' "
3 Ties 6"x10"x17' long
2 " 6"x10"x18' "
3 " 6"x10"x19' "
2 " 6"x10"x20' "


No 8, 8 & 5 Frogs, Stub Swi
No 8.
20'-11⅛"
25.7½
N.B.
7°9'
2'-11¼"
14'-11⅛"
3'
3'
11'-7½"
11'
4½"
9°36' Curve.
13°57' Curve.
1125.
2'-0⅝"
⅜"
9°36' Curve.
13°57' Curve.
4'-8½"
7°9'
No 8.
46'-6⅞"
18'-10"
Switch Ties 20" centre to centre.
1 Head Block 8"x16"x16' long.
6 Ties 6"x10"x11' "
4 " 6"x10"x12' "
3 " 6"x10"x13' "
3 " 6"x10"x14' "
3 " 6"x10"x15' "
2 " 6"x10"x16' "
3 Ties 6"x10" 17' long.
2 " 6"x10" 18' "
3 " 6"x10" 19' "
2 " 6"x10" 20' "


120
49'.6⅞"
10'.7½"
17'.11⅝"
11°5' Curve
10°50' Curve
18'.10"
N.E.
N.W.
N.S.
N.W.
N.E.
8'
8'10"
7'9"
15°58' Curve
16'.4⅛"
25'.7½"
Switch Tiles 20" centre to centre
1 Round Block 8"x16"x18" long
5 Tiles 6"x10"x18" "
6"x10"x12" "
6"x10"x13" "
6"x10"x14" "
6"x10"x15" "
6"x10"x16" "
6"x10"x17" "
7 2 Tiles 6"x10"x18" long
2 " 6"x10"x19" "
1 " 6"x10"x20" "
1 " 6"x10"x14" "
2 " 6"x10"x15" "


No 7, 7 & 5 Frogs, Stub Swit
No 7.
No 5.
H.B.
19'-4⅛"
25'-7½"
13'-4½"
11'-7⅛"
3'
11'
9°23'
18°20' Curve
13°57' Curve
13°37' Curve
9°10'
44'-11⅜"
18'-10"
4'-8½"
Switch Ties 20" centre to centre.
1 Head Block 8" x 16" - 16' long
2 Ties 6" x 10" - 10' "
4 " 6" x 10" - 11' "
4 " 6" x 10" - 12' "
3 " 6" x 10" - 13' "
3 " 6" x 10" - 14' "
3 Ties 6" x 10" - 15' long
3 " 6" x 10" - 16' "
3 " 6" x 10" - 17' "
3 " 6" x 10" - 18' "
3 " 6" x 10" - 19' "
3 " 6" x 10" - 20' "

No 6, 6 & 4 Frogs, Stub Switch.



Switch Ties 20" centre to centre.

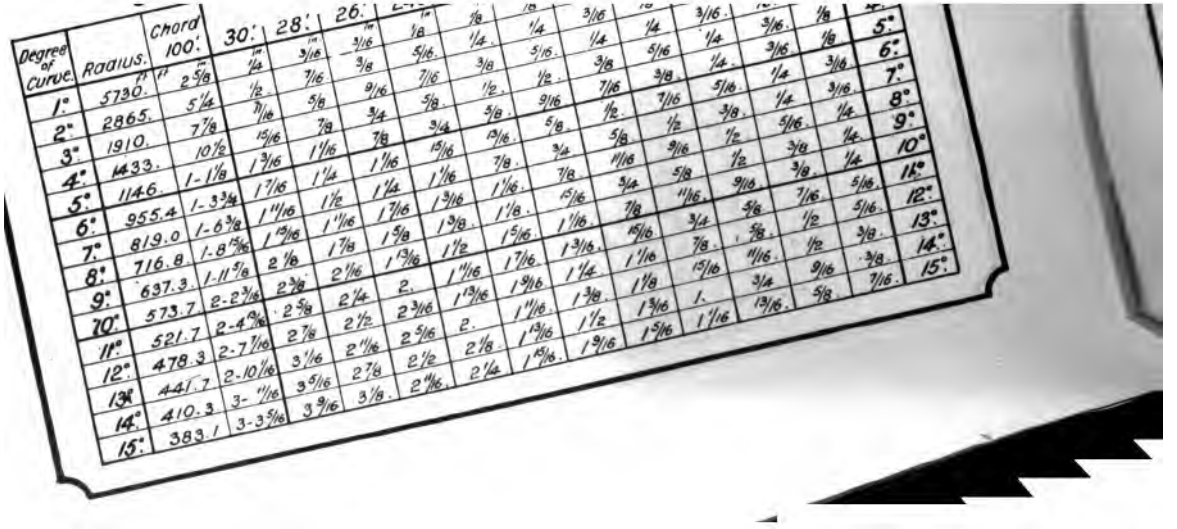
1 Head Block 8"x16"x16" long.

4 Ties	6"x10"x11" long	2 Ties	6"x10"x17" long
3 "	6"x10"x12" "	2 "	6"x10"x18" "
3 "	6"x10"x13" "	2 "	6"x10"x19" "
2 "	6"x10"x14" "	2 "	6"x10"x20" "
2 "	6"x10"x15" "	1 "	6"x10"x21" "
2 "	6"x10"x16" "		

Locations of Frogs in Crossovers.

DISTANCE B.

Nos of Frogs.	A = 13'	A = 12'6"	A = 12'.	A = 11'6"
4.	13'.11 1/8"	11'.10 3/4"	9'.10 1/2"	7'.10 1/8"
5.	17'.7 3/8"	15'.11 1/8"	12'.6 3/4"	10'.0 1/8"
6.	21'.2 5/8"	18'.2 3/8"	15'.2 1/8"	12'.1 7/8"
7.	24'.10 3/8"	21'.4 1/8"	17'.9 7/8"	14'.3 5/8"
8.	28'.2 7/8"	24'.3"	20'.3 1/4"	16'.3 1/2"
9.	31'.9 7/8"	27'.4 1/8"	22'.10 3/8"	18'.4 1/2"
10	35'.5"	30'.5 1/4"	25'.5 1/2"	20'.5 3/4"
11.	39'.1 1/2"	33'.7 1/2"	28'.1 1/2"	22'.7 5/8"
12.	42.9 3/4"	36'.9 3/4"	30.9 7/8"	24'.9 7/8"



Degree of Curve.	Radius.	Chord 100'.	30'.	28'.	26'.										
1°.	5730.	1' 2 5/8"	1/4"	3/16"	3/16"	1/8"	1/8"	1/4"	1/4"	1/4"	1/4"	1/4"	3/16"	1/8"	5°.
2°.	2865.	5 1/4"	1/2"	7/16"	3/8"	5/16"	1/4"	5/16"	5/16"	3/8"	5/16"	3/8"	3/16"	1/8"	6°.
3°.	1910.	7 7/8"	11/16"	5/8"	9/16"	7/16"	3/8"	1/2"	1/2"	7/16"	3/8"	1/4"	3/16"	3/16"	7°.
4°.	1433.	10 1/2"	15/16"	7/8"	3/4"	5/8"	1/2"	9/16"	7/16"	1/2"	7/16"	5/16"	1/4"	3/16"	8°.
5°.	1146.	1-1 1/8"	1 3/16"	1 1/16"	7/8"	3/4"	5/8"	5/8"	5/8"	1/2"	1/2"	3/8"	1/4"	1/4"	9°.
6°.	955.4	1-3 3/4"	1 7/16"	1 1/4"	1 1/16"	15/16"	13/16"	3/4"	11/16"	9/16"	1/2"	3/8"	1/4"	1/4"	10°.
7°.	819.0	1-6 3/8"	1 11/16"	1 1/2"	1 1/16"	1 1/16"	7/8"	7/8"	3/4"	5/8"	9/16"	3/8"	1/4"	5/16"	11°.
8°.	716.8	1-8 15/16"	1 15/16"	1 11/16"	1 7/16"	1 3/16"	1 1/16"	1 1/16"	15/16"	11/16"	5/8"	7/16"	5/16"	5/16"	12°.
9°.	637.3	1-11 5/16"	2 1/16"	1 7/8"	1 5/8"	1 3/8"	1 1/8"	1 1/16"	1 1/16"	3/4"	5/8"	1/2"	3/8"	3/8"	13°.
10°.	573.7	2-2 3/16"	2 3/16"	2 1/16"	1 13/16"	1 1/2"	1 5/16"	1 7/16"	1 3/16"	15/16"	11/16"	1/2"	3/8"	3/8"	14°.
11°.	521.7	2-4 5/16"	2 5/16"	2 1/4"	2"	1 11/16"	1 7/16"	1 9/16"	1 1/4"	1"	3/4"	1/2"	3/8"	7/16"	15°.
12°.	478.3	2-7 1/16"	2 7/16"	2 1/2"	2 3/16"	1 13/16"	1 9/16"	1 11/16"	1 3/8"	1 1/16"	7/8"	5/8"	1/2"		
13°.	441.7	2-10 1/16"	3 1/16"	2 11/16"	2 5/16"	2"	1 13/16"	1 11/16"	1 1/2"	1 1/16"	15/16"	11/16"	1/2"		
14°.	410.3	3- 1/16"	3 5/16"	2 7/8"	2 1/2"	2 1/16"	1 15/16"	1 13/16"	1 9/16"	1 1/16"	1"	3/4"	9/16"		
15°.	383.1	3-3 5/16"	3 9/16"	3 1/8"	2 11/16"	2 1/4"	2"	1 15/16"	1 5/16"	1 1/16"	1"	13/16"	5/8"		

MIDDLE-ORDINATES FOR BENDING RAILS. continued.

Ordinates at the quarters are 3/4 of Middle-Ordinates.

Degree of Curve	Radius.	Chord 100'.	LENGTH of RAILS. 30'.	28'.	26'.	24'.	22'.	20'.	18'.	16'.	14'.	12'.	10'.	Degree of Curve
	ft.	ft. in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	
16°	359.3	3-5 15/16	3 3/4	3 5/16	2 7/8	2 7/16	2 1/16	1 11/16	1 3/8	1 1/8	7/8	5/8	7/16	16°
17°	338.3	3-8 5/8	4.	3 1/2	3 1/16	2 9/16	2 3/16	1 13/16	1 7/16	1 3/16	7/8	11/16	7/16	17°
18°	319.6	3-11 1/4	4 1/4	3 11/16	3 3/16	2 11/16	2 5/16	1 7/8	1 9/16	1 1/4	15/16	11/16	1/2	18°
19°	302.9	4-1 9/16	4 1/2	3 7/8	3 3/8	2 7/8	2 7/16	2.	1 5/8	1 5/16	1.	3/4	1/2	19°
20°	287.9	4-4 1/2	4 3/4	4 1/8	3 9/16	3.	2 9/16	2 1/8	1 11/16	1 3/8	1 1/16	13/16	9/16	20°
21°	274.4	4-7 1/8	4 15/16	4 5/16	3 3/4	3 3/16	2 11/16	2 3/16	1 13/16	1 7/16	1 1/8	7/8	9/16	21°
22°	262.0	4-9 13/16	5 3/16	4 1/2	3 15/16	3 5/16	2 13/16	2 5/16	1 7/8	1 1/2	1 3/16	7/8	9/16	22°
23°	250.8	5-7/16	5 7/16	4 11/16	4 1/16	3 7/16	2 15/16	2 3/8	1 15/16	1 9/16	1 3/16	15/16	5/8	23°
24°	240.5	5-3 1/16	5 5/8	4 15/16	4 1/4	3 5/8	3 1/16	2 1/2	2 1/16	1 11/16	1 1/4	15/16	5/8	24°
25°	231.0	5-5 3/4	5 7/8	5 1/8	4 7/16	3 3/4	3 3/16	2 5/8	2 1/8	1 3/4	1 5/16	1.	11/16	25°
26°	222.3	5-8 3/8	6 1/16	5 5/16	4 5/8	3 7/8	3 5/16	2 11/16	2 3/16	1 13/16	1 3/8	1.	11/16	26°
27°	214.2	5-11.	6 5/16	5 1/2	4 3/4	4 1/16	3 7/16	2 13/16	2 5/16	1 7/8	1 7/16	1 1/16	11/16	27°
28°	206.7	6-1 11/16	6 9/16	5 11/16	4 15/16	4 3/16	3 9/16	2 15/16	2 3/8	1 15/16	1 7/16	1 1/8	3/4	28°
29°	199.7	6-4 3/8	6 13/16	5 7/8	5 1/8	4 3/8	3 5/8	3.	2 7/16	2.	1 1/2	1 1/8	3/4	29°

CURVE EASEMENTS.

Transitions from tangent to curve or from lighter curve to sharper curve by the introduction of equal chords of regularly increasing degree of curvature.

The object of easing curves at their extremities is to turn the truck gradually, and thus avoid shock to car and rail, and also to secure a gradually increasing elevation of the outer rail, without having that elevation unduly great at any point. It is manifest that the elevation due to a sharp curve cannot be used at the point where that curve is changed to a straight line without carrying a decreasing elevation for some distance from the point of curve along the straight line. This elevation on the straight line,

if at all pronounced, gives an unpleasant sensation, and it is the aim of good trackmen to adapt the line at the ends of curves to the super-elevation which they have to reach. The practical result of lining this part of the track by eye generally introduces an unnecessarily flat piece of curve and an unnecessarily sharp piece of curve into the transition, and the changing super-elevation seldom accords throughout the transition with the changing degree of curve.

The method pursued in the following tables secures a practically gradual transition, the ease of passage being dependent upon the length of chords used and upon the amount of change in the degree of curvature of successive chords. The stakes for lining the transitions can scarcely be set except by an engineer. The formulas for the various cases are within the easy comprehension and use of a competent surveyor. The functions of the transition curve which are used in the formulas and in laying out the work are illustrated by the seven "*plates*" immediately succeeding this text.

In the "*tables*" (I. to X. inclusive) the equal chords AB, BC, CD, and

DE, of the transition curves (AE of plates) are designated by the degree of the curve they subtend.

That end of an equal chord which joins an equal chord of less curvature is designated as the "small end," the other as the "large end;" thus B is the "small end" and C is "large end" of chord BC, of plates.

The transition curve uniting a tangent with a central curve of given degree of curvature should begin with its chord of least degree of curvature and be carried to the "large end" of the chord whose degree of curvature is next below that of the central curve. For example, to unite a 3° curve with a tangent, the suitable transition curve by Table IV. is the chords 0° 30′ to 2° 30′ inclusive. By Table X. the suitable transition curve is the chords 0° 15′ to 2° 45′ inclusive.

The transition curve uniting branches of a compound curve should be between the limits of the chord whose degree of curvature is next above that of the lighter one of the branches of the compound curve, and the chord whose degree of curvature is next below that of the sharper one of

f the compound curve. For example, to unite a
suitable transition curve, by Table III., is the
y Table IX. the suitable transition curve is the
sive. The limitations of the transition curve
above, the functions used in formulas (under
taken from Sections A, B, C, D and E of su
. inclusive, as represents the transition adopt
"B" of the tables give, above the heavy hor
from the tangent through the "small end"
of column to the "large end" of the ch
transition represented b

Sections "B" of the tables give below the heavy horizontal lines of tables the projections upon the tangent through the "small end" of chord marked at foot of column. of the lines joining that point of tangent with the "large end" of the chords marked on the left. These lines joining the ends of the equal chords are hereafter designated "long chords." For example, in the transition represented by Table IV., the projection upon the tangent through the "small end" of the 0° 30′ chord of the "long chord" joining the "small end" of the 0° 30′ chord with the "large end" of the 2° 30′ chord, is found below heavy horizontal line of Table IV., Section "B," in column marked at the foot 0° 30′ and in space marked on the left 2° 30′, and it is 249.88 ft. Also, for further example, in the transition represented by Table IX., the projection upon the tangent through the "small end" of the 2° 30′ chord, of the "long chord,"

.l end" of the 2° 30′ chord with the "large e...
)und below heavy horizontal line of Table IX.,
marked at the foot 2° 30′ and in space marked on
4.65 ft.
)ctions of long chords upon tangents" are illustr

" of the tables give the prolongations of the radi
"small end" of chord at head of first column
he chord in that and other columns. For ex
)resented by Table IV., the prolongation of t
" of the 2° 30′ chord to the tangent th
found in Table IV., Sectio

.91 ft These "prolongations of radii to tangent"
'late 3.

Sections "D" of the tables give above the heavy
)bles, the lengths of the "long chord" joining the "
ıords marked at head of column, with the "large e
arked on the right. For example, in the transition rep
'., the length of the "long chord" joining the "sn
30′ chord with the "large end" of the 2° 30′ chord is fo
:izontal line of Table IV., Section "D", in column ma
30′, and in the space marked on the right 2° 3
Also for further

tables the angles between the tangent through the "small end" of the chord marked at foot of column, and the tangent through the "large end" of chord marked at left. The angles, therefore, represent the amount of change in direction accomplished within the limits of the transition. For example, in the transition represented by Table IV., the angle between the tangent through the "small end" of the 0° 30′ chord and the tangent through the "large end" of the 2° 30′ chord is found below the heavy horizontal line of Table IV., Section "D," in column marked at the foot 0° 30′ and in space marked on the left 2° 30′, and it is 3° 45′. For further example, in the transition represented by Table IX. the angle between the tangent through the "small end" of the 2° 30′ chord and the tangent through the "large end" of the 5° 30′ chord is found below the heavy horizontal line of Table IX., Section "D," in column marked at the foot 2° 30′ and in space marked on the left 5° 30′, and it is 7°. The "curvature due to compounding" is illustrated by Plate 5.

Sections "E" of the tables give the distances on the tangent through the "small end" of the chord marked at head of first column, from that

point of tangent to an intersection with radii prolonged through th ends" of that chord and the chords marked at the head of other For example, in the transition represented by Table IV., the dis the tangent through the "small end" of the 0° 30′ chord from th point to the intersection with the radius prolonged through th end" of the 2° 30′ chord, is found in Table IV., Section "E" i marked 2° 30′, and it is 250.28 ft.

For further example, in the transition represented by Table distance on the tangent through the "small end" of the 0° 15′ ch the tangent point to the intersection with the radius prolonged thr "large end" of the 2° 45′ chord, is found in Table A., Section column marked 2° 45′, and it is 275.35 ft. This "tangent lengt pounding" is illustrated on Plate 3 The limits of the curve with sition having been determined by formulas in cases 1 to 4 inclu points of transition may be established by the deflection angles Sections "A" of the tables.

The angles below the heavy horizontal lines of tables are those

the tangent through the "small end" of the chord marked at bottom of column and lines from that point of tangent to the "large ends" of the chords marked on the left. These angles are illustrated on Plate 6. The angles above the heavy horizontal lines of tables are those between the tangent through the "large end" of the chord marked at head of column and lines from that point of tangent to the "small end" of the chords marked on the right. These angles are illustrated on Plate 7. For example, it is desired to set stakes for transition from a tangent up to a 3° curve, using chords of 50 ft. length, varying 15′ in degree of curvature. The angles to turn off are found in Table V., Section "A". The point of curve is in this case the "small end" of the 0° 15′ chord, and the angles to turn from a set up at this point are found below the heavy horizontal line of Table V., Section "A," in column marked 0° 15′ at its foot. The deflection to the "large end" of the 0° 15′ chord is 3½′, and is found in this column in the space marked 0° 15′ on left. The deflection from same set up to the "large end" of the 0° 30′ chord is 9½′, and so on to a deflection of 2° 52½′ to the "large end" of the 2° 45′ chord.

The angle between the "long chord" joining the "large end" of the 2° 45′ chord with the "small end" of the 0° 15′ chord, and the tangent at the "large end" of the 2° 45′ chord, is found above the heavy horizontal line of table in column marked 2° 45′ at the head, and in the space marked 0° 15′ on the right, and it is 5° 22½′.

It may be necessary to make an intermediate set up as at the "large end" of the 1° 15′ chord. The deflection to this point from the tangent through the "small end" of the 0° 15′ chord is 41′. The angle which the "long chord" connecting the "large end" of the 1° 15′ chord with the "small end" of the 0° 15′ chord makes with the tangent through the "large end" of the 1° 15′ chord is found above the heavy horizontal line of table in column marked at the head 1° 15′, and in space marked on right 0° 15′, and it is 1° 11½′. From this tangent, which is the tangent through the "large end" of the 1° 15′ chord, or through the "small end" of the 1° 30′ chord, the deflections to continue the curve are found below the heavy horizontal line of table in column marked at the foot 1° 30′, and they are 22½′, 47′, 1° 43′, 2° 15′ and 2° 49½′.

The angle at the "large end" of the 2° 45′ chord or at the beg
of the 3° chord, between the "long chord" joining the "large end" of
the 2° 45′ chord with the "small end" of the 1° 30′ chord and the tangent
through the "large end" of the 2° 45′ chord, is found above the heavy
horizontal line of table in column marked at the head 2° 45′ and in space
marked on the right 1° 30′, and is 3° 33′.

In locating points for the same transition from the end of the 3°
chord to the tangent, the first set up is at the "large end" of the 2° 45′
chord, and the deflections are turned from the tangent through that point
to the "small end" of the successive chords. The deflections are found
above the heavy horizontal lines of table in columns marked 2° 45′ at the
head and are to "small ends" of the chords marked on the right. They
are 41½′, 1° 20½′, etc., to 5° 22½′, which last deflection is to the "small end"
of the 0° 15′ chord, or the end of the transition. The angle between the
[illegible]" joining the "small end" of the 0° 15′ chord with the "large
[illegible]ord, and the tangent through the "small end" of the
[illegible] heavy horizontal line of table in column

marked at the foot 0° 15′ and in space marked on th
2° 52½′. If an intermediate set up is used the angles
way to that already described.

Case I. illustrates the ordinary joining of two tan
any desired curve eased by a similar transition curv
plies where the exact point of curve and point of ta
material consequence as other features of location a

In making a "paper location," it may be necessa
the central part of an ea ed curve will lie. This
correctly between the limits of the "central curve
tangents with a simple curve of the same degree
"central curve."

These parallel tangents will lie inside the tan
amount equal to the "offset from tangent to end of
easement and "central curve" (see QE., Plate I.), L
sine of ½ the "curvature due to compounding" $\left(\frac{K}{-}\right.$

length of the "central curve" which would be required to accomplish the curvature represented by KFC. For instance, to determine where a 4° curve eased by transition given in Table IV. would lie. In this case QE = 15.26 ft. and KFC = 7°. The amount of 4° curve required to accomplish 7° of curvature is 175 ft. Therefore 15.26 — (sine ½° × 175) = 4.58 ft. = the distance between tangent of location and tangent to a simple 4° curve, which will occupy the same position as the "central curve" to within 175 ft. of the points at which the simple curve joins the parallel tangent.

Case II. applies to the infrequent contingency when the exact point of curve and point of tangent are of paramount importance.

Case III. is mainly of use in the adaptation of transition curves to the end of simple curves already built and in operation.

Tables XII. to XVIII. inclusive give data which will show the changes in line which will follow the use of the various transitions given in Tables I. to V. inclusive, when only a part of the original curve is changed.

These tables evidently will apply only to long curves, as it is not advisa-

ble to introduce an "intermediate curve" (joining easement and loca curve) which shall differ much in degree of curvature from the loca curve.

The various modifications of the first problem of Case III. will, ho ever, generally give data for eased curves which will relieve that difficul somewhat and will not require material changes in the roadbed if jud ciously applied.

It is important to observe in all the problems under Case III. that i the line AB falls inside of the line AM instead of outside of that line, as shown, that the angle BAM becomes a negative quantity and is to be used as such in the formulas.

Case IV. is difficult to apply only because the point E is hard to find in an old curve when a transition between the branches has been attempted by trackmen. It can be found near enough to its original position by establishing D on the lighter branch and B on the sharper branch at sufficient distances from the supposed location of E and using the degree of curvature of either branch to determine the exact degree of curvatur

ıd the position of *E*, by the well known formula which
ius and extent of one branch of a compound curve,
the other branch and the controlling angles and dis-

ıse IV. is, in many instances, as valuable as those
ɔr the same purposes of turning trucks gradually and
consistently with degree of curvature.

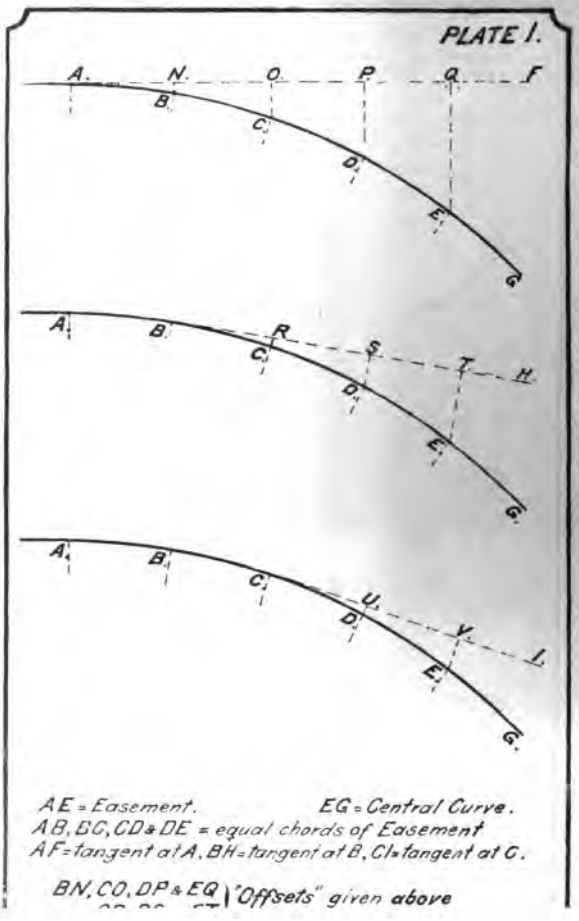
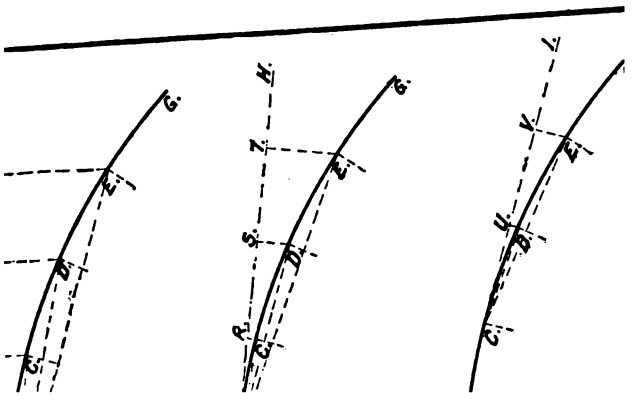


PLATE I.
A
N
O
P
Q
F
B
C
D
E
G
A
B
R
S
T
H
B
C
D
E
G
A
B
C
U
D
Y
I
E
G
AE = Easement.
EG = Central Curve.
AB, BC, CD & DE = equal chords of Easement
AF = tangent at A. BH = tangent at B. CI = tangent at C.
BN, CO, DP & EQ \ "Offsets" given above

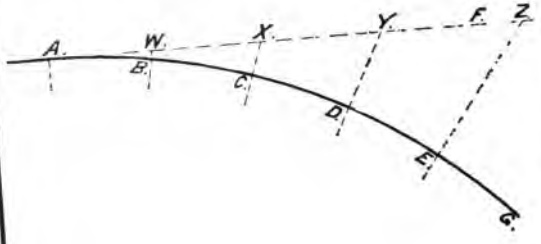

G.
Z.
B.
C.
H.
Z.
S.
B.
P.
C.
G.
Z.
L.
K.
Y.
B.
C.

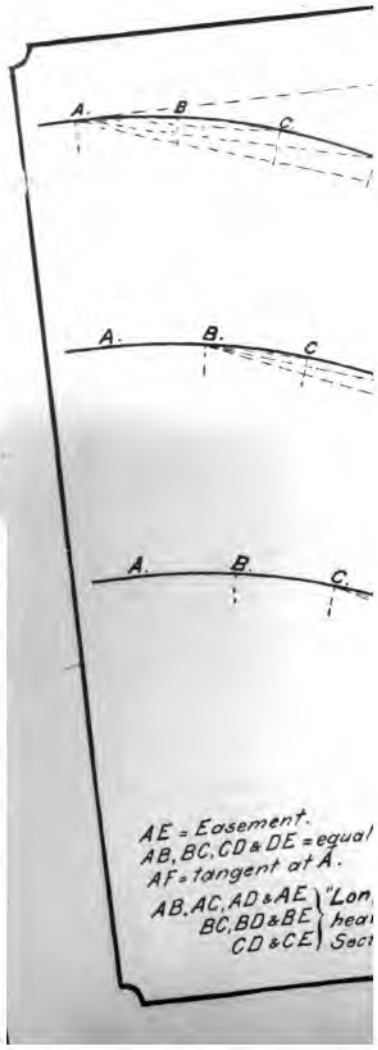
A, B, C, D & DE = equal chords of Easement.
AF = tangent at A, BH = tangent at B, CI = tangent at C.

AN, AO, AP & AQ } "Projections of long Chords"
BR, BS & BT } given below heavy horizontal
CU & CV } lines in Sections "B" of Tables.

PLATE 3.

AE = Easement
EG = Central Curve
AB, BC, CD & DE = equal chords of Easement
AF = tangent at A.
BW, CX, DY & EZ = "Prolongations of radii to tangent given in Sections "C" of Tables.




A.
B
C
A.
B.
C
A.
B.
C.
AE = Easement.
AB, BC, CD & DE = equal
AF = tangent at A.
AB, AC, AD & AE
BC, BD & BE
CD & CE

AB, BC, CD & DE = equal ch
AF = tangent at A.

AB, AC, AD & AE } "Long C
BC, BD & BE } heavy h
CD & CE } Section

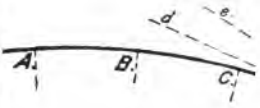
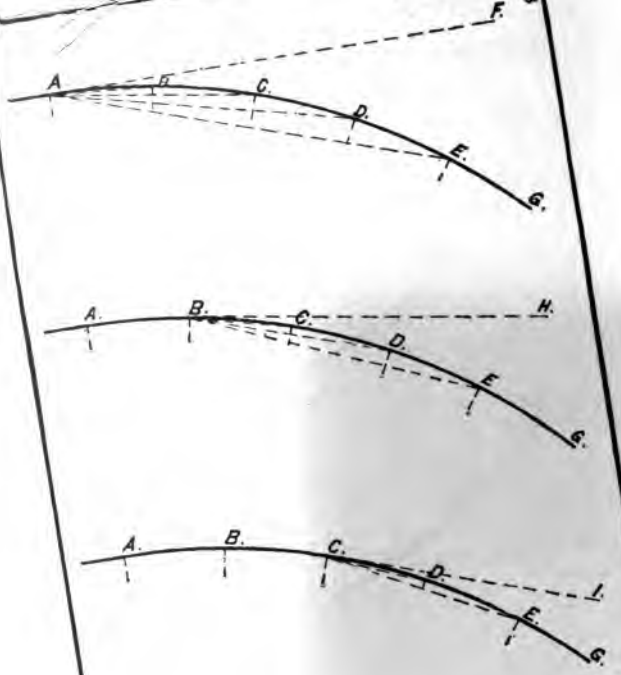


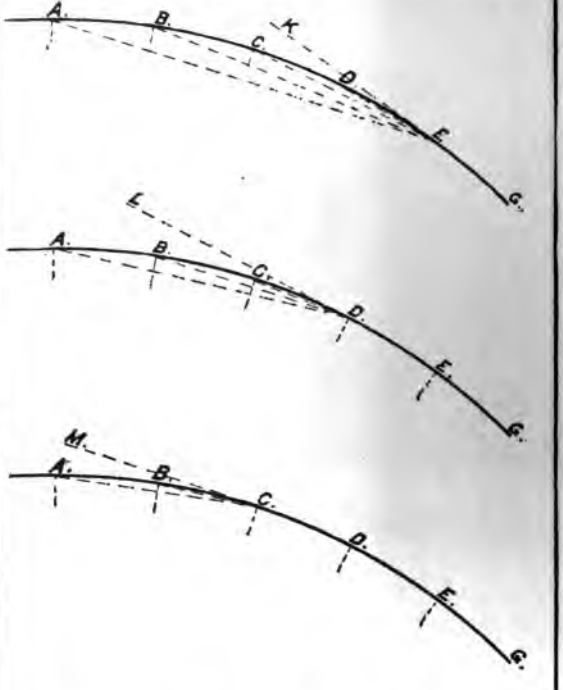
PLATE 6.



AE = Easement. EG = Central Curve.
AB, BC, CD & DE = equal chords of Easement.
AF = tangent at A., BH = tangent at B., CI = tangent at C.

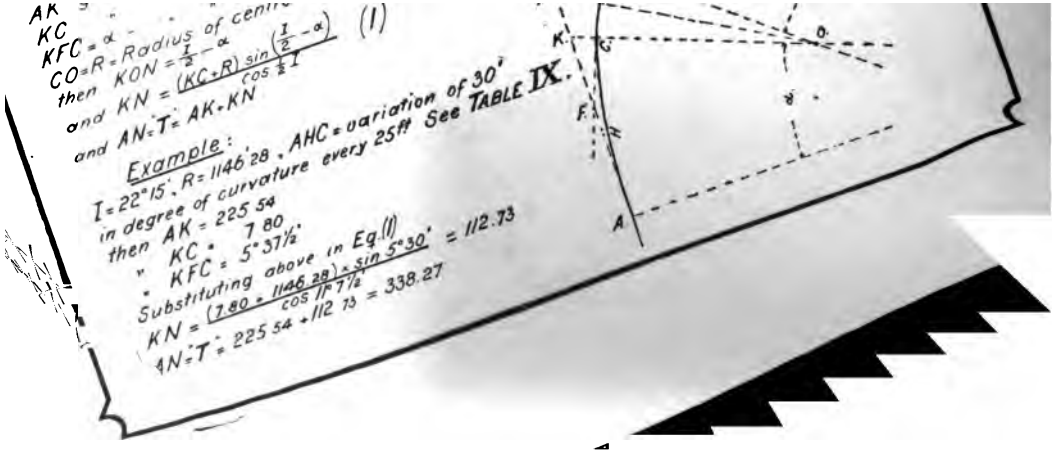
FAB, FAC, FAD & FAE
HBC, HBD & HBE
ICD & ICE
} Deflections given below heavy horizontal lines in Sections "A" of Tables.

PLATE 7.



AE = Easement. EG = Central Curve.
AB, BC, CD & DE = equal chords of Easement.
EK = tangent at E, DL = tangent at D, CM = tangent at C.

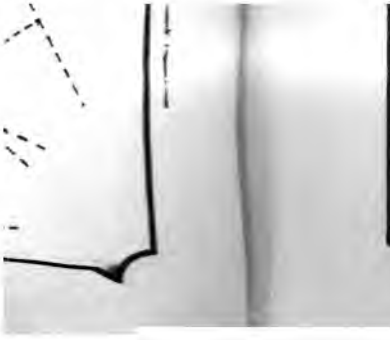
KED, KEC, KEB & KEA } Deflections given above heavy horizontal lines
LDC, LDB & LDA }



AK
KC
KFC = α
CO = R = Radius of centre
then KON = $\frac{I}{2} - \alpha$
and KN = $\frac{(KC + R)\sin\left(\frac{I}{2} - \alpha\right)}{\cos\frac{1}{2}I}$ (1)
and AN = T = AK + KN

Example:
I = 22°15', R = 1146'28", AHC = variation of 30' in degree of curvature every 25ft See TABLE IX.
then AK = 225.54
" KC = 7.80
" KFC = 5°37½'
Substituting above in Eq.(1)
KN = $\frac{(7.80 + 1146.28)\sin 5°30'}{\cos 11°7½'}$ = 112.73
AN = T = 225.54 + 112.73 = 338.27

K
C
O
F
H
A



Example:

$I = 22°15'$, $T = 338.27$

then $l = 3.33$

Assume easement from Table IX for 8 chords

then by Eq(2) $\frac{11°7\frac{1}{2}' - 4°30'}{3.33 - 2} = \frac{6.625°}{1.33} = 5°$ abt, showing that easement should be carried farther.

Assume easement from Table IX for 9 chords

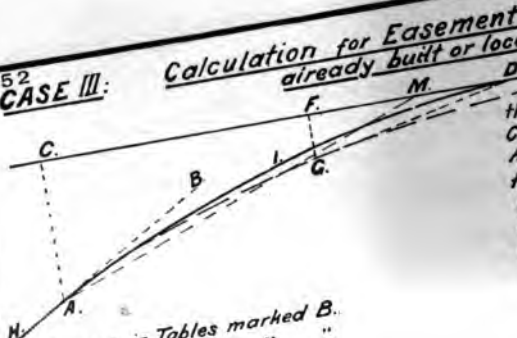
then by Eq(2) $\frac{11°7\frac{1}{2}' - 5°37\frac{1}{2}'}{3.33 - 2.25} = \frac{5.5°}{1.08} = 5°$ abt.,

showing that easement is suitable.

Substituting the proper values of last easement in Eq(3)

$$R = \frac{(338.271 - 225.54) \cdot \cos 11°7\frac{1}{2}'}{\sin(11°7\frac{1}{2}' - 5°37\frac{1}{2}')} - 7.8 = 1146.28$$

CASE III: Calculation for Easement of a simple Curve already built or located.



FG given in Tables marked B.
FK " " " " D.
FDG " " " "
CMI = Tangent
HAI = simple Curve.
AGK = change for easeme

Take any point A on curve, beyond which it is not desireable to change line of track. Take also any point M on Tangent or Tangent prolonged Observe angle CMA and angle BAM between tangent at A and line AM. Measure AM.

then:
CA = AM. sin CMA and CM = AM. cos CMA.
Assume easement GK
then Chord $AG = \frac{CA - FG}{\sin \frac{1}{2}(CMA + BAM + FDG)}$
$CF = AG \cos \frac{1}{2}(CMA + BAM + FDG)$
$MK = FK + CF - CM.$
R of interm. Curve $= \frac{\text{chord } AG}{2 \sin \frac{1}{2}(CMA + BAM - FDG)}$

Example.

HAI = 3° curve.
CMA = 7°, BAM = 5°, AM = 342 48
CA = 342.48 × sin.7° = 41.74
CM = 342.48 × cos.7° = 339.93
Easement from Table III 1°&2° Chords.
Chord $AG = \frac{41.74 - 1.09}{\sin 6°45'} = 345.85.$
CF = 345.85 cos.6°45' = 343.45
MK = 99.99 + 343.45 − 339 93 = 103.51
$R = \frac{345.85}{2 \sin 3°15'} = 1889\ 8 = 3°2'$ Curve

CASE III (continued).

In providing for the easement of the ends of a **short curve** when the "intermediate curve" would be inconveniently sharp by following precisely the method first given under CASE III, an advantage may be had by moving out the middle of the curve any desired amount HA.

Put tangent BAB' parallel with tangent at H, assume any points M and M' on original tangents, observe angles CMA & BAM and angles C'M'A & B'AM'. Measure AM and AM', and find "intermediate curves" (which will be tangent to each other at A) and limits of easements as in first given method under CASE III.

III (continued).

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long curve, when the "inter.
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by following precisely the
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middle of the curve any
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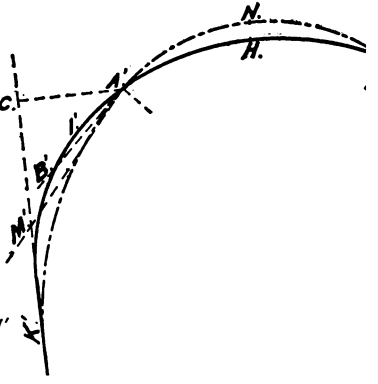
al tangents.



Disregarding C, $AF = \frac{KF - AG}{\cos \alpha}$ (9)

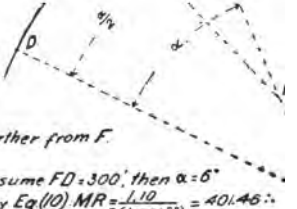
Take any point D on curve ED and make $APS = \frac{1}{2}\alpha$

Then $DM + MR - 2MR \cdot \cos \frac{1}{2}\alpha = SP = AM - MR$

$$MR = \frac{AM - DM}{2(1 - \cos \frac{1}{2}\alpha)} = \frac{AF}{2(1 - \cos \frac{1}{2}\alpha)} \quad (10)$$

$DR = DM + MR = R$, $PA = DM + AF - MR = R'$

If this gives too great diff betw R & R' assume D further from F.



Example

BE = 6° curve, EFD = 2°. Easement from TABLE III. Assume FD = 300', then $\alpha = 6°$

by Eq (6) $EF = \frac{6° - 2° \cdot 1.5}{6° - 2°} = 0.75$ stations of 100' and by Eq (10) $MR = \frac{1.10}{2(1 - \cos 3°)} = 401.46$ ∴

∴ (7): $AG = 149.94 \cdot \sin 3°20 = 8.72$ DR = 3266.46, and PA = 2463.54

∴ (8): $KF = 75 \sin 2°15' - 75 \sin 5°15' = 9.81$ Taking C into account the exact radii a

∴ (9): $AF = \frac{1.09}{\cos 8°} = 1.10$ 3265.17 and 2466.40.

TABLE I.— 100Ft Chords. Variation.

A.

	1°	2°	3°	4°	5°	6°	
	' "	' "	' "	' "	' "	' "	
	30	1-45	3-40	6-15	9-30	13-25½	1°
1°	30	1-0	2-45	5-10	8-15	12-0	2°
2°	1-15	1-0	1-30	3-45	6-40	10-15	3°
3°	2-20	2-15	1-30				
				2-0	4-45	8-10	4°
4°	3-45	3-50	3-15	2-0	2-30	5-45	5°
5°	5-30	5-45	5-20	4-15	2-30	3-0	6°
6°	7-34½	8-0	7-45	6-50	5-15	3-0	
	1°	2°	3°	4°	5°	6°	

B. Offsets from Tangent to Ends of Chords

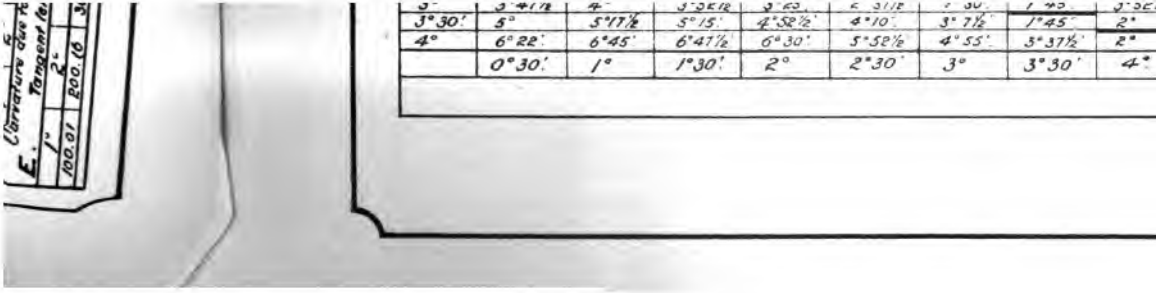
	6°	5°	4°	3°	2°	1°	
	5.23	18.28	35.60	53.72	69.21	78.67	6°
1°	99.59	4.36	14.81	27.84	39.97	47.77	5°
2°	199.98	99.98	3.49	11.33	20.04	26.13	4°
3°	299.63	199.80	99.37				
				2.62	7.85	12.21	3°
4°	398.65	299.05	199.59	99.94	1.74	4.36	2°
5°	496.28	397.05	298.21	199.30	99.90	.87	1°
6°	591.39	492.68	394.81	297.11	198.93	99.86	
	1°	2°	3°	4°	5°	6°	

Projections of long Chords on Tangent.

C. Prolongation of Radius to Tangent.

1°	2°	3°	4°	5°	6°
.87	4.37	12.27	26.53	49.45	84.27

D. Long Chords.



Curvature	Tangent	Ext.
1°	2°	3°
100.01	200.16	300.3

3°	3°47½	4°	3°52½	3°53	4°3½	4°30'	1°45'	3°30'
3°30'	5°	5°17½	5°15'	4°52½'	4°10'	3°7½'	1°45'	2°
4°	6°22'	6°45'	6°47½'	6°30'	5°52½	4°55'	3°37½'	2°
	0°30'	1°	1°30'	2°	2°30'	3°	3°30'	4°

TABLE II (continued) 100 Ft Chords. 30' Variation.

B. Offsets from Tangent to Ends of Chords.

	4°	3°30'	3°	2°30'	2°	1°30'	1°	0°30'	
	3.49	12.64	25.68	40.86	56.44	70.69	81.92	88.39	4°
0°30'	100.00	3.05	10.90	19.08	33.94	45.65	55.20	60.83	3°30'
1°	199.98	100.00	2.62	9.16	17.87	27.00	34.83	39.61	3°
1°30	299.91	199.95	99.99	2.18	7.41	13.95	20.05	23.97	2°30'
2°	399.66	299.76	199.90	99.98					
					1.75	5.67	10.03	13.08	2°
2°30	499.07	399.26	299.55	199.82	99.98	1.31	3.93	6.11	1°30'
3°	597.94	498.16	398.70	299.26	199.73	99.97	.87	2.18	1°
3°30	695.56	596.06	496.94	397.98	298.93	199.62	99.95	.44	0°30'
4°	791.69	692.43	593.76	495.41	397.10	298.52	199.49	99.94	
	0°30	1°	1°30'	2°	2°30'	3°	3°30'	4°	

Projections of Long Chords on Tangent.

C. Prolongation of Radius to Tangent.

0°30	1°	1°30'	2°	2°30'	3°	3°30'	4°
.44	2.18	6.12	13.13	24.18	40.29	62.69	92.94

TABLE II (continued) 100 Ft Chords. 30' Variation.

D. Long Chords

	4°	3°30'	3°	2°30	2°	1°30'	1°	0°30°	
	100	199.89	299.63	399.19	498.62	597.95	697.26	796.60	4°
0°30'	30'	100.	199.92	299.73	399.42	499.04	598.61	698.21	3°30'
1°	1°30'	1°	100.	199.94	299.61	399.61	499.38	599.15	3°
1°30'	3°	2°30'	1°30'	100.	199.97	299.88	399.76	499.65	2°30'
2°	5°	4°30'	3°30'	2°					
					100.	199.98	299.93	399.80	2°
2°30'	7°30'	7°	6°	4°30'	2°30	100.	199.99	299.97	1°30'
3°	10°30'	10°	9°	7°30'	3°30'	3°	100.	200.	1°
3°30'	14°	13°30'	12°30'	11°	9°	6°30'	3°30'	100.	0°30'
4°	18°	17°30'	16°30'	15°	13°	10°30'	7°30'	4°	
	0°30'	1°	1°30'	2°	2°30'	3°	3°30'	4°.	

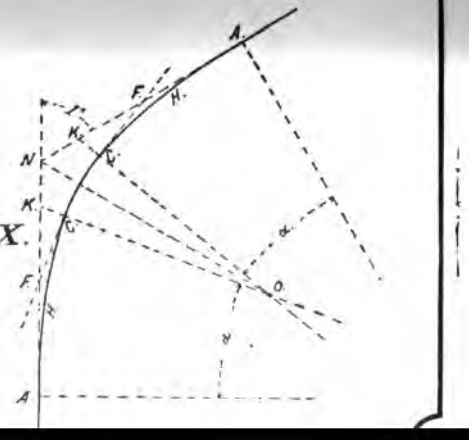
Curvature due to compounding at each end of curve.

E. Tangent length of compounding.

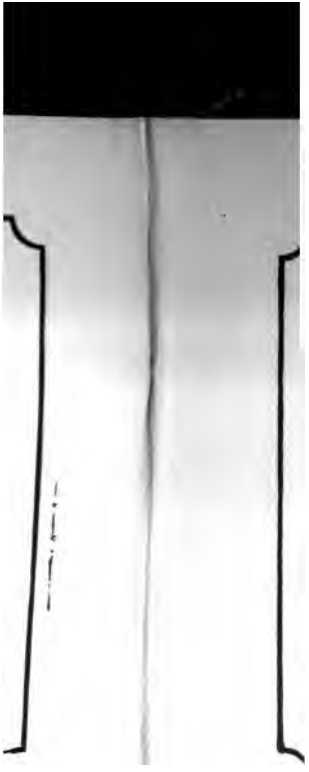
0°30'	1°	1°30'	2°	2°30'	3°	3°30°	4°
100.	200.04	300.23	400.81	502.22	605 18	710.73	820.41

CASE I: Calculation for tangent length "T" of a given central curve and easement similar at each end.

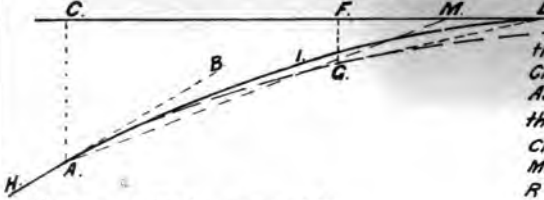
Use any suitable easement AHC.
AK given in tables marked E.
KC " " " " C.
KFC = α " " " " D.
CO = R = Radius of central curve.
then $KON = \frac{I}{2} - \alpha$
and $KN = \frac{(KC + R)\sin\left(\frac{I}{2} - \alpha\right)}{\cos\frac{1}{2}I}$ (1)
and AN = "T" = AK + KN



Example:
I = 22°15', R = 1146'28, AHC = variation of 30' in degree of curvature every 25ft See TABLE IX.
then AK = 225 54
" KC = 7 80
" KFC = 5°37½'
Substituting above in Eq (1)
$KN = \frac{(7.80 + 1146.28)\sin 5°30'}{\cos 11°7\frac{1}{2}'} = 112.73$
AN = "T" = 225 54 + 112 73 = 338 27



CASE III: Calculation for Easement of a simple Curve already built or located.



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CMI(= Tangent
HAI = simple Curve
AGK = change for easeme

Take any point A on curve, beyond which it is not desireable to change line of track. Take also any point M on Tangent or Tangent prolonged Observe angle CMA and angle BAM between tangent at A and line AM. Measure AM.

then:
CA = AM. sin CMA and CM = AM. cos. CMA.
Assume easement GK
then Chord $AG = \frac{CA - FG}{\sin \frac{1}{2}(CMA + BAM + FDG)}$
$CF = AG \cos \frac{1}{2}(CMA + BAM + FDG)$
MK = FK + CF - CM.
R of interm. Curve = $\frac{\text{chord } AG}{2 \sin \frac{1}{2}(CMA + BAM - FDG)}$

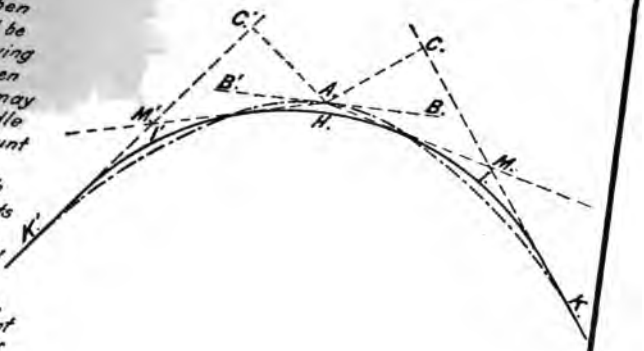
Example.

HAI = 3° curve.
CMA = 7°; BAM = 5°, AM = 342 48
CA = 342.48 × sin.7° = 41.74
CM = 342.48 × cos.7° = 339.93
Easement from Table III 1°&2° Chords.
Chord $AG = \frac{41.74 - 1.09}{\sin 6°45'} = 345.85$.
CF = 345.85 cos.6°45' = 343.45
MK = 99.99 + 343.45 - 339.93 = 103.51
$R = \frac{345.85}{2 \sin 3°15'} = 1889.8 = 3°2'$ Curve

CASE III (continued).

In providing for the easement of the ends of a **short curve** when the "intermediate curve" would be inconveniently sharp by following precisely the method first given under CASE III, an advantage may be had by moving out the middle of the curve any desired amount HA.

Put tangent BAB' parallel with tangent at H, assume any points M and M' on original tangents, observe angles CMA & BAM and angles C'M'A & B'AM'. Measure AM and AM', and find "intermediate curves" (which will be tangent to each other at A) and limits of easements as in first given method under CASE III.



ASE III (continued).

oviding for the easement of the
of a long curve, when the "inter-
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taken at even stations from H
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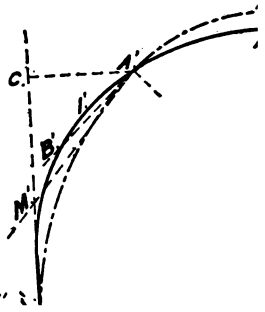
and A'B' are tangents to curve



Total curvature C degrees in l stations of 100 ft.
Let c" = degree of curve BE, c' = degree of curve ED
∴ BE = l" stations of 100 ft, BF = l' stations of 100 ft.
∴ BTA be tangent at B, and angle c" = angle c.
Then: c'l' + c"l" = c, and l' + l" = l
∴ $l" = \frac{c - c'l}{c" - c'}$ (6)
and $l' = l - l"$.

Chord AB requires increment C to reach radius through F.

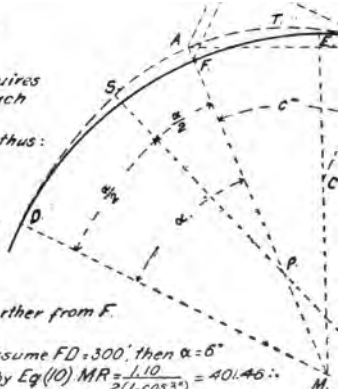
Put compound curve betw A and D. Approx. radii found thus:
AG = AB sin ABG (from TABLES A & D) (7)
KF = l"100 · sin ½c"l" + l'100 · sin(½c'l' + c"l") (8).

Disregarding C, $AF = \frac{KF - AG}{\cos C}$ (9)

Take any point D on curve ED and make APS = ½α
Then DM - MR - 2MR cos ½α = SP = AM - MR

$MR = \frac{AM - DM}{2(1 - \cos ½\alpha)} = \frac{AF}{2(1 - \cos ½\alpha)}$ (10)

DR = DM + MR = R, PA = DM + AF - MR = R'
If this gives too great diff betw R & R' assume D further from F.



Example.

BE = 6° curve, EFD = 2°, Easement from TABLE III. Assume FD = 300', then α = 6°
by Eq (6) $EF = \frac{6° - 2°}{6 - 2} \times 1.5 = 0.75$ stations of 100' and by Eq (10) $MR = \frac{1.10}{2(1 - \cos 3°)} = 401.46$ ∴
" " (7): AG = 149.94 · sin 3°20 = 8.72 DR = 3266.46, and PA = 2463.54
" " (8): KF = 75 sin 2°15' + 75 sin 5°15' = 9.81 Taking C into account the exact radii are
" " (9): $AF = \frac{1.09}{\cos 6°} = 1.10$ 3265.17 and 2466.40.

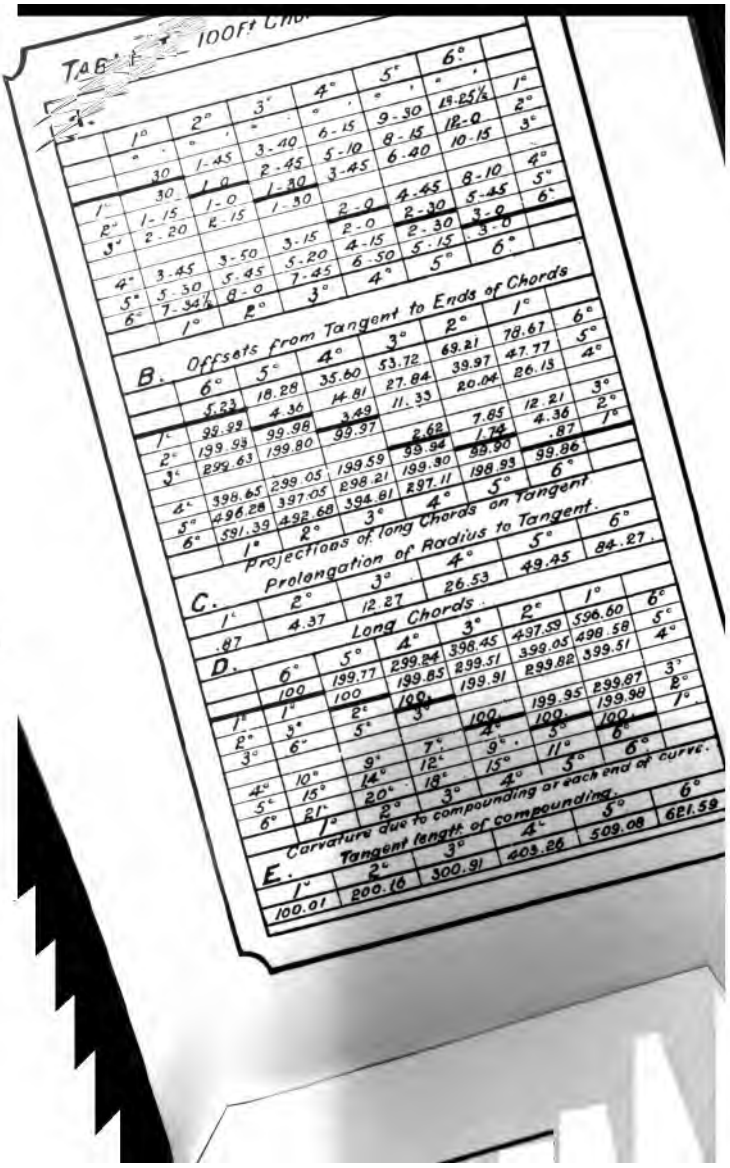


TABLE — 100Ft Chd

	1°	2°	3°	4°	5°	6°
	° '	° '	° '	° '	° '	° '
30	1-45	3-40	6-15	9-30	13-25½	1°
1°	1-0	2-45	5-10	8-15	12-0	2°
30	1-0	1-30	3-45	6-40	10-15	3°
1°	1-0	1-30				
2°	1-15	1-15	2-0	4-45	8-10	4°
3°	2-20		2-0	2-30	5-45	5°
		3-15	4-15	2-30	3-0	6°
4°	3-45	3-50	5-20	6-50	5-15	
5°	5-30	5-45	7-45	4°	5°	6°
6°	7-34½	8-0	3°			
	1°	2°				

B. Offsets from Tangent to Ends of Chords

	1°	2°	3°	4°	5°	6°
1°	.87	3.49	7.85	12.21	17.67	24.33
2°	3.49	13.97	31.42	55.87	87.29	125.71
3°	7.85	31.42	70.69	125.71	196.40	282.85
4°	13.97	55.87	125.71	223.49	349.20	502.84
5°	21.82	87.29	196.40	349.20	545.60	785.69
6°	31.42	125.71	282.85	502.84	785.69	1131.37

C. Projections of Long Chords on Tangent.

Prolongation of Radius to Tangent.

	1°	2°	3°	4°	5°	6°
1°	.87	4.37	12.27	26.53	49.45	84.27

D. Long Chords.

	1°	2°	3°	4°	5°	6°
100	100	100	100	100	100	100
1°	1°	2°	3°	4°	5°	6°
2°	3°	5°	7°	9°	11°	13°
3°	6°	9°	12°	15°	18°	21°
4°	10°	14°	18°	22°	26°	30°
5°	15°	20°	25°	30°	35°	40°
6°	21°	28°	34°	40°	46°	52°

	1°	2°	3°	4°	5°	6°
1°	100.01	200.16	300.91	403.26	509.08	621.59
2°	200.16	400.64	602.41	806.98	1018.93	1243.70
3°	300.91	602.41	905.74	1213.49	1532.31	1870.74
4°	403.26	806.98	1213.49	1626.23	2054.00	2508.70
5°	509.08	1018.93	1532.31	2054.00	2596.00	3171.70
6°	621.59	1243.70	1870.74	2508.70	3171.70	3876.70

E. Curvature due to compounding at each end of curve.

Tangent length of compounding.

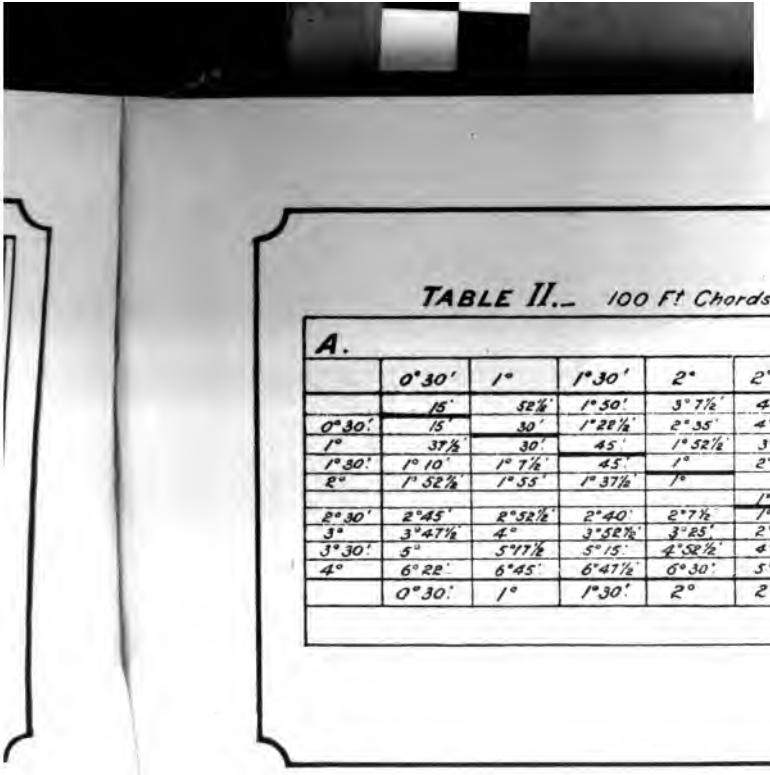


TABLE II.— 100 Ft Chords.

A.

	0°30'	1°	1°30'	2°	2°3
	15'	52½'	1°30'	3°7½'	4°4
0°30'	15'	30'	1°22½'	2°35'	4°7
1°	37½'	30'	45'	1°52½'	3°2
1°30'	1°10'	1°7½'	45'	1°	2°2
2°	1°52½'	1°55'	1°37½'	1°	
					1°4
2°30'	2°45'	2°52½'	2°40'	2°7½'	1°7
3°	3°47½'	4°	3°52½'	3°25'	2°3
3°30'	5°	5°17½'	5°15'	4°52½'	4°1
4°	6°22'	6°45'	6°47½'	6°30'	5°5
	0°30'	1°	1°30'	2°	2°3

TABLE I. 100 Ft Chords. 1° Variation.

A.

	1°	2°	3°	4°	5°	6°	
	° '	° '	° '	° '	° '	° '	
	30	1-45	3-40	6-15	9-30	13-25½	1°
1°	30	1-0	2-45	5-10	8-15	12-0	2°
2°	1-15	1-0	1-30	3-45	6-40	10-15	3°
3°	2-20	1-15	1-30				
				2-0	4-45	8-10	4°
4°	3-45	3-50	3-15	2-0	2-30	5-45	5°
5°	5-30	5-45	5-20	4-15	2-30	3-0	6°
6°	7-34½	8-0	7-45	6-50	5-15	3-0	
	1°	2°	3°	4°	5°	6°	

B. Offsets from Tangent to Ends of Chords

	6°	5°	4°	3°	2°	1°	
	5.23	18.28	35.60	53.72	69.21	78.67	6°
1°	99.99	4.36	14.81	27.84	39.97	47.77	5°
2°	199.93	99.98	3.49	11.33	20.04	26.13	4°
3°	299.63	199.80	99.97				
				2.62	7.85	12.21	3°
4°	398.65	299.05	199.59	99.94	1.74	4.36	2°
5°	496.26	397.05	298.21	199.30	99.90	.87	1°
6°	591.39	492.68	394.81	297.11	198.93	99.86	
	1°	2°	3°	4°	5°	6°	

Projections of long Chords on Tangent

C. Prolongation of Radius to Tangent.

1°	2°	3°	4°	5°	6°
.87	4.37	12.27	26.53	49.45	84.27.

D. Long Chords.

	6°	5°	4°	3°	2°	1°	
	100	199.77	299.24	398.45	497.59	596.60	6°
1°	1°	100	199.85	299.51	399.05	498.58	5°
2°	3°	2°	100.	199.91	299.82	399.51	4°
3°	6°	5°	3°				
				100.	199.95	299.87	3°
4°	10°	9°	7°	4°	100.	199.98	2°
5°	15°	14°	12°	9°	5°	100.	1°
6°	21°	20°	18°	15°	11°	6°	
	1°	2°	3°	4°	5°	6°	

Carvature due to compounding at each end of curve.

E. Tangent length of compounding.

1°	2°	3°	4°	5°	6°
100.01	200.16	300.91	403.26	509.08	621.59

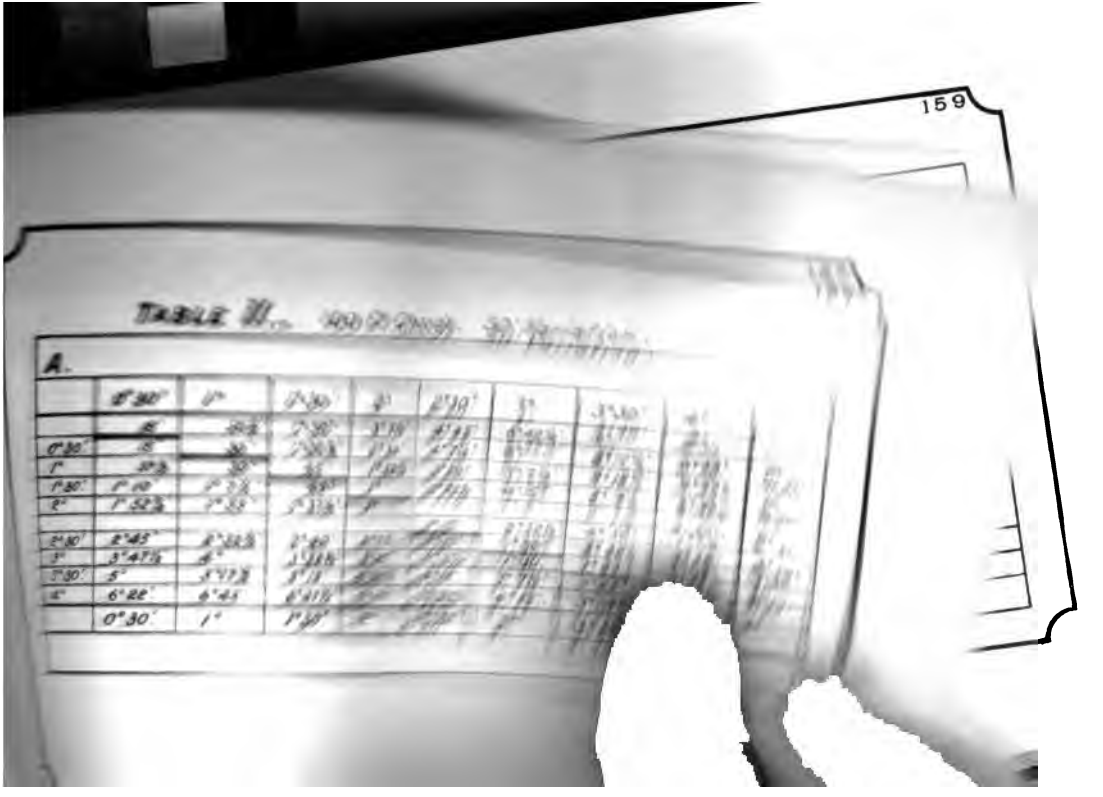


TABLE II.

A.

TABLE II (continued) 100 Ft. Chords. 30' Variation.

B. Offsets from Tangent to Ends of Chords.

	4°	3°30'	3°	2°30'	2°	1°30'	1°	0°30'	
	3.49	12.64	25.68	40.86	56.44	70.69	81.92	88.39	4°
0°30'	100.00	3.05	10.90	19.08	33.94	45.65	55.20	60.83	3°30'
1°	199.98	100.00	2.62	9.16	17.87	27.00	34.83	39.61	3°
1°30	299.91	199.95	99.99	2.18	7.41	13.95	20.05	23.97	2°30'
2°	399.66	299.76	199.90	99.98					
					1.75	5.67	10.03	13.08	2°
2°30'	499.07	399.26	299.55	199.82	99.98	1.31	3.93	6.11	1°30'
3°	597.84	498.16	398.70	299.28	199.73	99.97	.87	2.18	1°
3°30	695.56	596.06	496.94	397.98	298.93	199.62	99.95	.44	0°30'
4°	791.69	692.43	593.76	495.41	397.10	298.52	199.49	99.94	
	0°30	1°	1°30'	2°	2°30'	3°	3°30'	4°	

Projections of Long Chords on Tangent.

C. Prolongation of Radius to Tangent.

0°30	1°	1°30'	2°	2°30'	3°	3°30'	4°
.44	2.18	6.12	13.13	24.18	40.29	62.69	92.94

TABLE II (continued) 100 Ft Chords. 30' Variation.

D. Long Chords

	4°	3°30'	3°	2°30	2°	1°30'	1°	0°30'	
	100	199.89	299.63	399.19	498.62	597.95	697.26	796.60	4°
0°30'	30'	100.	199.92	299.73	399.42	498.94	598.61	698.21	3°30'
1°	1°30'	1°	100.	199.94	299.81	399.61	499.38	599.15	3°
1°30'	3°	2°30'	1°30'	100.	199.97	299.88	399.76	499.65	2°30'
2°	5°	4°30'	3°30'	2°					
					100.	199.98	299.93	399.88	2°
2°30'	7°30'	7°	6°	4°30'	2°30'	100.	199.99	299.97	1°30'
3°	10°30'	10°	9°	7°30'	5°30'	3°	100.	200.	1°
3°30'	14°	13°30'	12°30'	11°	9°	6°30'	3°30'	100.	0°30'
4°	18°	17°30'	16°30'	15°	13°	10°30'	7°30'	4°	
	0°30'	1°	1°30'	2°	2°30'	3°	3°30'	4°	

Curvature due to compounding at each end of curve.

E. Tangent length of compounding.

0°30'	1°	1°30'	2°	2°30'	3°	3°30'	4°
100.	200.04	300.23	400.81	502.22	605.18	710.73	820.41

TABLE III.— 50 Ft Chords. 1° Variation

A.

	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	
	15'	52½'	1°50'	3°7½'	4°45'	6°42½'	9°	11°38'	14°35½'	17°33½'	21°31½'	25°30'	1°
1°	15'	30'	1°22½'	2°35'	4°7½'	6°	8°12½'	10°45'	13°38'	16°30½'	20°24'	24°17'	2°
2°	37½'	30'	45'	1°52½'	3°20'	5°7½'	7°15'	9°98½'	12°30'	15°38'	19°6'	22°54'	3°
3°	1°10'	1°7½'	45'	1°	2°22½'	4°5'	6°7½'	8°30'	11°12½'	14°15½'	17°38'	21°21½'	4°
4°	1°52½'	1°55'	1°37½'	1°									
					1°15'	2°52½'	4°50'	7°7½'	9°45'	12°42½'	16°½'	19°38½'	5°
5°	2°45'	2°52½'	2°40'	2°7½'	1°15'	1°30'	3°22½'	5°35'	8°7½'	11°	14°13'	17°45½'	6°
6°	3°47½'	4°	3°52½'	3°25'	2°37½'	1°30'	1°45'	3°52½'	6°20'	9°7½'	12°15'	15°43'	7°
7°	5°	5°17½'	5°15'	4°52½'	4°10'	3°7½'	1°45'	2°	4°22½'	7°5'	10°7½'	13°30'	8°
8°	6°22'	6°45'	5°47½'	6°30'	5°52½'	4°55'	3°37½'	2°					
									2°15'	4°52½'	7°50'	11°7½'	9°
9°	7°54½'	8°22'	8°30'	8°17½'	7°45'	6°52½'	5°40'	4°7½'	2°15'	2°30'	5°22½'	8°35'	10°
10°	9°36½'	10°9½'	10°22'	10°14½'	9°47½'	9°	7°52½'	6°25'	4°37½'	2°30'	2°45'	5°52½'	11°
11°	11°28½'	12°6'	12°24'	12°22'	11°59½'	11°17'	10°15'	8°52½'	7°10'	5°7½'	2°45'	5°	12°
12°	13°30'	14°13'	14°36'	14°38½'	14°21½'	13°44½'	12°47'	11°30'	9°52½'	7°55'	5°37½'	3°	
	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	

TABLE III (continued) 50Ft Chords. 1° Varia

B. Offsets from Tangent to ends of Chords

	12°	11°	10°	9°	8°	7°	6°	5°	4°	3°
	2.62	3.79	20.60	34.12	49.45	65.78	82.10	97.76	111.90	123.73
1°	50.	8.80	8.92	18 67	30.72	44.20	58.85	72.01	84.67	95.41
2°	99.99	50.	2.78	8.06	16 73	27.31	38.91	50.63	61.78	71.36
3°	149.95	99.87	50	1.86	7.19	14.79	23.67	33.58	43.05	51.42
4°	199.83	149.88	99.95	49.98						
					1.74	6.32	12.86	20.43	28.22	35.35
5°	249.53	199.63	149.78	99.91	49.99	1.53	5.45	10.89	16.97	22.83
6°	298.98	249.06	199 55	149 64	99 87	49 96	1 30	4 58	8 93	13.60
7°	347.78	298.03	248.47	198 99	149.47	99.81	49.98	1.09	3.71	6.98
8°	395.84	346.21	296 88	247.70	198.35	149.26	99.75	49.97		
									.67	2.84
9°	442.75	393 27	344.23	296.48	246.79	198.03	149.02	99 67	49.96	.65
10°	488.07	438.77	390.06	341 82	293.77	245.71	197.43	148.75	99.50	49.95
11°	531 26	482.18	433.91	386 27	338.93	291.62	244.49	196.76	148.45	99.50
12°	571 71	522 89	475.12	428 20	381 85	335.77	289.62	243.12	196.00	148.11
	1°.	2°.	3°.	4°.	5°.	6°.	7°.	8°.	9°.	10°

Projections of Long Chords on Tangent.

C. Prolongation of Radius to Tangent

1°	2°	3°	4°	5°	6°	7°	8°	9°	10
22	1.09	3.06	6.57	12.09	20.14	31 35	46 47	66 57	93

TABLE III (continued). — 50 Ft Chords. 1° Variation.

D. Long Chord.

	12°	11°	10°	9°	8°	7°	6°	5°	4°	3°	2°	1°	
	50	99 87	149.54	198.95	248.09	296.98	345.66	395.08	442.58	490.97	539.40	587.95	12°
1°	30'	50	99 89	149 62	199.14	248.45	297.59	346.56	395.44	444.28	493.14	542 09	11°
2°	1° 30'	1°	50.	99 91	149 69	199.31	248.78	298.11	347.36	396.55	445.75	495.01	10°
3°	3°	2° 30'	1° 30'	50.	99.93	149.77	199.46	249.06	298.58	348.04	397.51	447.	9°
4°	5°	4° 30'	3° 30'	2°									
					50.	99.95	149.81	199 60	249 31	298 97	349 63	398.30	8°
5°	7° 30'	7°	6°	4° 30'	2° 30'	50.	99.96	149.87	199 71	249 52	299 31	349 11	7°
6°	10° 30'	10°	9°	7° 30'	5° 30'	3°	50.	99 97	149.90	199 81	249 69	299 57	6°
7°	14°	13° 30'	12° 30	11°	9°	6° 30'	3° 30	50	99 98	149 94	199 88	249 82	5°
8°	18°	17° 30'	16° 30	15°	13°	10° 30'	7° 30'	4°					
									50.	99 99	149 97	199 94	4°
9°	22° 30	22°	21°	19° 30'	17° 30'	15°	12°	8° 30'	4° 30'	50.	99 99	149 99	3°
10°	27° 30	27°	26°	24° 30'	22° 30'	20°	17°	13° 30'	9° 30'	5°	50.	99 99	2°
11°	33°	32° 30	31° 30'	30°	28°	25° 30	22° 30'	19°	15°	10° 30'	5° 30'	50.	1°
12°	39°	38° 30'	37° 30	36°	34°	31° 30'	28° 30'	25°	21°	16° 30'	11° 30'	6°	
	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	

Curvature due to compounding at each end of curve.

E. Tangent length of compounding.

1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°
30	100.02	150. 11	200 40	251. 11	302.59	355 36	410.20	468 23	531.08	601 28	682 82.

TABLE IV.— 50 Ft Chords. 30' Variation.

A.

	0°30'	1°	1°30'	2°	2°30'	3°	3°30'	4°	4°30'	5°	5°30'	6°
	7½'	26'	35'	1° 34'	2°22½'	3°21'	4°30'	5°49'	7°17½'	8°56½'	10°45'	12°44'
0°30'	7½'	18'	41'	1°17½'	2°4'	3°	4°6'	5°22½'	6°49'	8°25'	10°11½'	12°8'
1°	19'	18'	22½'	56'	1°40'	2°34'	3°37½'	4°51'	6°15'	7°43'	9°32½'	11°26½'
1°30'	35'	34'	22½'	30'	1°11'	2°2½'	3°4'	4°15'	5°36½'	7°7½'	8°49'	10°40'
2°	56'	57½'	49'	30'								
					37½'	1°26'	2°25'	3°34'	4°52½'	6°21½'	8°	9°49'
2°30'	1°22½'	1°26'	1°20'	1°4'	37½'	45'	1°41'	2°47½'	4°4'	5°30'	7°6½'	8°52½'
3°	1°54'	2°	1°56'	1°42½'	1°19'	45'	52½'	1°56'	3°10'	4°34'	6°7½'	7°51½'
3°30'	2°30'	2°39'	2°37½'	2°26'	2°5'	1°34'	52½'	1°	2°11'	3°32½'	5°4'	6°45'
4°	3°11'	3°22½'	3°24'	3°15'	2°56'	2°27½'	1°49'	1°				
									1°7½'	2°26'	3°55'	5°34'
4°30'	3°57½'	4°11'	4°15'	4°8¾'	3°52½'	3°26'	2°30'	2° 4'	1°7½'	1°15'	2°41'	4°17½'
5°	4°48½'	5°5'	5°11'	5°7½'	4°53½'	4°30'	3°56'	3°12½'	2°19'	1°15'	1°22½'	2°56'
5°30'	5°45'	6°3½'	6°12½'	6°11'	6'	5°38½'	5°7¼'	4°26'	3°35'	2°34'	1°22½'	1°30'
6°	6°46'	7°7'	7°18½'	7°20'	7°11'	6°52½'	6°23½'	5°45'	4°56'	3°57½'	2°49'	1°30'
	0°30'	1°	1°30'	2°	2°30'	3°	3°30'	4°	4°30'	5°	5°30'	6°

TABLE IV (continued). — 50 Ft Chords. 30' Variat...

B. Offsets from Tangent to ends of Chords.

	6°	5°30'	5°	4°30'	4°	3°30'	3°	2°30'	2°	1°30'	1°	0°30'	
	1.31	4.90	10.35	17.19	25.00	33.33	41.76	49.85	57.18	63.32	67.85	70.32	6°
0°30'	.50	1.80	4.47	9.37	15.46	22.30	29.45	36.49	42.98	48.49	52.60	54.87	5°30'
1°	1.00	.50	1.09	4.03	8.39	13.72	19.59	25.56	31.20	36.08	39.77	41.63	5°
1°30	1.49	1.00	.50	.98	3.60	7.41	11.98	16.88	21.66	25.90	29.16	31.00	4°30'
2°	1.99	1.49	1.00	.50	.87	3.16	6.43	10.24	14.16	17.75	20.58	22.21	4°
2°30	2.49	1.99	1.49	1.00	.50	.78	2.73	5.45	8.50	11.44	13.84	15.26	3°30'
3°	2.99	2.49	1.99	1.49	1.00	.50	.65	2.29	4.47	6.76	8.72	9.98	3°
3°30	3.49	2.99	2.49	1.99	1.49	1.00	.50	.55	1.85	3.49	5.02	6.00	2°30'
4°	3.98	3.49	2.99	2.49	1.99	1.49	1.00	.50	.44	1.42	2.51	3.27	2°
4°30	4.48	3.98	3.49	2.99	2.49	1.99	1.49	1.00	.50	.33	.98	1.53	1°30'
5°	4.98	4.48	3.98	3.49	2.99	2.49	1.99	1.49	1.00	.50	.38	.55	1°
5°30	5.48	4.98	4.48	3.98	3.49	2.99	2.49	1.99	1.49	1.00	.50	.11	0°30'
6°	5.98	5.48	4.98	4.48	3.98	3.49	2.99	2.49	1.99	1.49	1.00	.50	

Prolongation of Radius to Tangent.

	0°30'	1°	1°30'	2°	2°30'	3°	3°30'	4°	4°30'	5°	5°30'	6°
	1° 30'	2°	2°30'	3°	3°30'	4°	4°30'	5°	5°30'	6°		
C	3.28	6.01	9.96	15.37	22.49	31.61	43.06	57.23	74.60.			

Projections of Long Chords on Tangent.

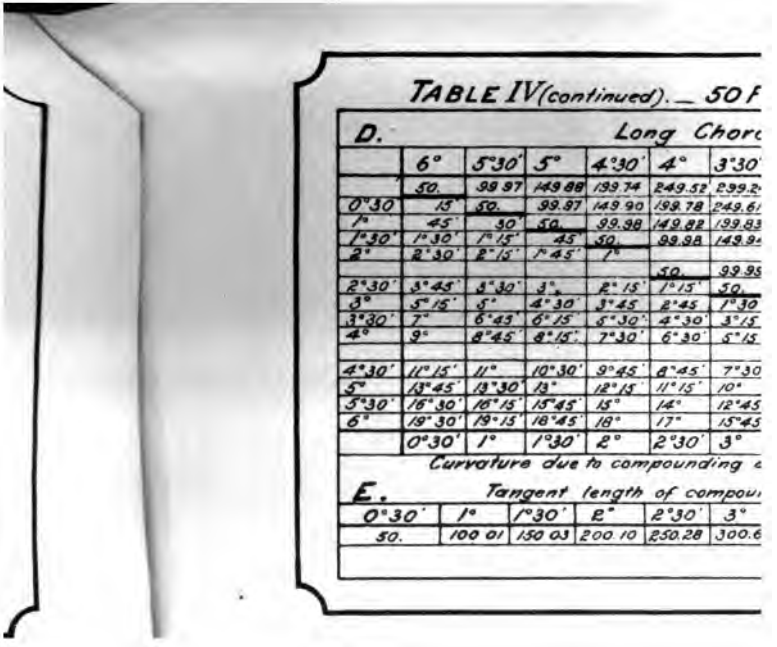


TABLE IV (continued). — 50 F

D. Long Chor

	6°	5°30'	5°	4°30'	4°	3°30'
	50.	99.97	149.88	199.74	249.53	299.2
0°30'	15'	50.	99.97	149.90	199.78	249.61
1°	45'	30'	50.	99.98	149.92	199.83
1°30'	1°30'	1°15'	45'	50.	99.98	149.9
2°	2°30'	2°15'	1°45'	1°		
					50.	99.9
2°30'	3°45'	3°30'	3°	2°15'	1°15'	50.
3°	5°15'	5°	4°30'	3°45'	2°45'	1°30'
3°30'	7°	6°45'	6°15'	5°30'	4°30'	3°15'
4°	9°	8°45'	8°15'	7°30'	6°30'	5°15'
4°30'	11°15'	11°	10°30'	9°45'	8°45'	7°30
5°	13°45'	13°30'	13°	12°15'	11°15'	10°
5°30'	16°30'	16°15'	15°45'	15°	14°	12°45
6°	19°30'	19°15'	18°45'	18°	17°	15°45
	0°30'	1°	1°30'	2°	2°30'	3°

Curvature due to compounding

E. Tangent length of compou

0°30'	1°	1°30'	2°	2°30'	3°
50.	100.01	150.03	200.10	250.28	300.6

TABLE V.— 50 Ft Chords 15' Variation.

A.

	0°15'	0°30'	0°45'	1°	1°15'	1°30'	1°45'	2°	2°15'	2°30'	2°45'	3°	
	4'	13'	27½'	47'	1°11½'	1°40½'	2°15'	2°54½'	3°39'	4°28'	5°22½'	6°22'	0°15'
0°15'	3½'	7½'	20½'	39'	1° 2'	1°30'	2° 3'	2°41½'	3°24½'	4°12½'	5°5½'	6° 4'	0°30'
0°30'	3½'	7½'	11½'	28'	50'	1°17'	1°49'	2°25½'	3°7½'	3°56½'	4°46½'	5°43'	0°45'
0°45'	17½'	17'	11'	15'	35½'	1°1½'	1°32'	2°7½'	2°48'	3°34'	4°24½'	5°20'	1°
1°	28'	28½'	24½'	15'									
					19'	43'	1°12½'	1°47'	2°26½'	3°10½'	4°	4°54½'	1°15'
1°15'	41'	43'	40'	32'	19½'	22½'	50½'	1°24'	2° 2'	2°45'	3°33'	4°26½'	1°30'
1°30'	57'	1°	58'	51'	39½'	22¼'	26½'	58'	1°35'	2°17'	3° 4'	3°55½'	1°45'
1°45'	1°15'	1°19½'	1°18½'	1°13'	1° 2½'	47'	26'	30'	1°5½'	1°46½'	2°32'	3°22½'	2°
2°	1°35½'	1°41'	1°42'	1°37¼'	1°28'	1°13½'	54½'	30'					
									34'	1° 13'	1°57½'	2°47'	2°15'
2°15'	1°58½'	2°5½'	2° 7½'	2°4½'	1°56'	1°43'	1°25'	1° 2'	33½'	37½'	1°20½'	2° 9'	2°30'
2°30'	2°24½'	2°32½'	2°35½'	2°33½'	2°27'	2°15'	1°58'	1°36'	1°9½'	37½'	41½'	1°28'	2°45'
2°45'	2°52½'	3° 2'	3° 6'	3° 5½'	3°	2°49½'	2°33½'	2°13'	1°47½'	1°17'	41'	45'	3°
	3°21'	3°33½'	3°39½'	3°40'	3°35½'	3°26'	3°12'	2°52½'	2°28'	1°58½'	1°24½'	45'	
	0°15'	0°30'	0°45'	1°	1°15'	1°30'	1°45'	2°	2°15'	2°30'	2°45'	3°	

TABLE V (continued).— 50 Ft Chords. 15' Variation.

B. Offsets from Tangent to ends of Chords

	3°	2°45'	2°30'	2°15'	2°	1°45'	1°30'	1°15'	1°	0°45'	0°30'	0°15'	
	.66	2.45	5.15	8.60	12.53	16.72	20.97	25.06	28.75	31.85	34.13	35.37	3°
0°15'	50.	60	2.24	4.69	7.74	11.17	14.77	18.31	21.57	24.35	26.42	27.55	2°45'
0°30'	100.	50.	55	2.02	4.20	6.87	9.81	12.82	15.64	18.09	19.94	20.99	2°30'
0°45'	150.	100.	50.	49	1.80	3.71	6.00	8.46	10.85	12.97	14.61	15.53	2°15'
1°	199.99	149.99	100.	50.									
					.44	1.58	3.22	5.12	7.09	8.89	10.31	11.12	2°
1°15'	249.97	199.98	149.99	100.	50.	.38	1.36	2.73	4.25	5.73	6.93	7.63	1°45'
1°30'	299.93	249.94	199.96	149.98	99.99	50.	.33	1.14	2.24	3.38	4.36	4.96	1°30'
1°45'	349.86	299.88	249.90	199.94	149.97	99.99	50.	.27	.93	1.75	2.51	3.00	1°15'
2°	399.74	349.76	299.80	249.86	199.91	149.95	99.99	50.					
									.22	.71	1.26	1.64	1°
2°15'	449.54	399.58	349.64	299.72	249.80	199.88	149.94	99.98	50.	.16	.49	.76	0°45'
2°30'	499.25	449.29	399.37	349.48	299.61	249.73	199.84	149.92	99.98	50.	.11	.27	0°30'
2°45'	548.81	498.87	448.98	399.13	349.30	299.48	249.65	199.80	149.90	99.97	50.	.05	0°15'
3°	598.20	548.27	498.42	448.61	398.85	349.10	299.24	249.56	199.75	149.88	99.96	50.	
	0°15'	0°30'	0°45'	1°	1°15'	1°30'	1°45'	2°	2°15'	2°30'	2°45'	3°	

Projection of long Chords on Tangent.

C. Prolongation of Radius to Tangent

0°15'	0°30'	0°45'	1°	1°15'	1°30'	1°45'	2°	2°15'	2°30'	2°45'	3°
.05	.27	.76	1.64	3.00	4.97	7.65	11.16	15.61	21.13	27.84	35.89

TABLE V (continued).— 50 Ft Chords. 15' Variation.

D. Long Chords.

	3°	2°45'	2°30'	2°15'	2°	1°45'	1°30'	1°15'	1°	0°45'	0°30'	0°15'	
	50.	99.99	149.98	199.94	249.88	299.81	349.73	399.63	449.53	499.43	549.33	599.25	3°
0°15'	7½'	50.	99.99	149.98	199.95	249.90	299.85	349.78	399.71	449.64	499.57	549.50	2°45'
0°30'	22½'	15'	50.	100.	149.98	199.96	249.92	299.88	349.83	399.78	449.73	499.69	2°30'
0°45'	45'	37½'	22½	50	100	149.99	199.97	249.94	299.91	349.86	399.84	449.82	2°15'
1°	1°15'	1°7½'	52½'	30'									
					50.	100.	149.99	199.97	249.96	299.94	349.92	399.89	2°
1°15'	1°52½	1°45'	1°30'	1°7½'	57½	50	100.	149.99	199.98	249.97	299.95	349.94	1°45'
1°30'	2°37½'	2°30'	2°15'	1°52½	1°22½	45'	50.	100.	149.99	199.99	249.98	299.97	1°30'
1°45'	3°30'	3°22½	3°7½	2°45'	2°15'	1°37½	52½	50.	100.	150.	199.99	249.99	1°15'
2°	4°30'	4°22½	4°7½	3°45'	3°15'	2°37½	1°52½	1°					
									50.	100.	150.	200.	1°
2°15'	5°37½	5°30'	5°15'	4°52½	4°22½	3°45'	3°	2°7½	1°7½'	50.	100.	150.	0°45'
2°30'	6°52½	6°45'	6°30'	6°7½	5°37½	5°	4°15'	3°22½	2°22½	1°15'	50.	100.	0°30'
2°45'	8°15'	8°7½	7°52½	7°30'	7°	6°22½	5°37½	4°45'	3°45'	2°37½	1°22½	50.	0°15'
3°	9°45'	9°37½	9°22½	9°	8°30'	7°52½	7°7½	6°15'	5°15'	4°7½'	2°52½	1°30'	
	0°15'	0°30'	0°45'	1°	1°15'	1°30'	1°45'	2°	2°15'	2°30'	2°45'	3°	

Curvature due to compounding at each end of curve.

E. Tangent length of compounding

0°15'	0°30'	0°45'	1°	1°15'	1°30'	1°45'	2°	2°15'	2°30'	2°45'	3°.
50	100	150.01	200.03	250.07	300.16	350.33	400.62	451.07	501.78	552.80	604.28

TABLE VI. 25 Ft Chords. 2° Variation.

A.

	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	
	15'	52½'	1°50'	3° 7½'	4°45	6°42½'	9°	11°37½'	14°35½'	17°53½'	2°
2°	15'	30'	1°22½'	2°35'	4° 7½'	6°	8°12½'	10°45'	13°38'	16°50½'	4°
4°	37½'	30'	45'	1°52½'	3°20'	5° 7½'	7°15'	9°42½'	12°30	15°38	6°
6°	1°10'	1° 7½'	45'	1°	2°22½'	4°8½'	6°10'	8°34'	11°16'	14°18	8°
8°	1°52½'	1°55	1°37½'	1°	1°15'	2°52½'	4°50	7° 7½'	9°45'	12°42½'	10°
10°	2°45'	2°52½'	2°40'	2° 7½'	1°15						
						1°30'	3°22½'	5°35'	8° 7½'	11° 0'	12°
12°	3°47½'	4°	3°52½'	3°21¼'	2°37½'	1°30'	1°45'	3°52½'	6°20'	9° 7½'	14°
14°	5°	5°17½'	5°15'	4°50'	4°10'	3° 7½'	1°45'	2°	4°22½'	7° 5	16°
16°	6°22½'	6°45	6°47½'	6°26'	5°52½'	4°55	3°37½'	2°	2°15'	4°52½'	18°
18°	7°54½'	8°22'	8°30'	8°14'	7°45'	6°52½'	5°40'	4°7½'	2°15'	2°30'	20°
20°	9°36½'	10°9½'	10°22'	10°12	9°47½'	9°	7°52½'	6°25'	4°37½'	2°30'	
	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	

TABLE VI (continued).— 25 Ft Chords.. 2° Variation.

B. Offsets from Tangent to ends of Chords.

	20'	18°	16°	14°	12°	10°	8°	6°	4°	2°	
	1.09	4.03	8.36	13.65	19.46	25.34	30.74	35.68	39.30	41.32	20°
2°	25.	.98	3.59	7.39	11.94	16.79	21.37	25.71	28.93	30.75	18°
4°	50.	25.	.87	3.16	6.42	10.21	13.96	17.67	20.48	22.10	16°
6°	74.99	49.99	25.	.76	2.72	5.44	8.41	11.41	13.80	15.21	14°
8°	99.92	74.94	49.97	25	.65	2.29	4.39	6.75	8.71	9.90	12°
10°	124.77	99.81	74.89	49.96	24.99						
						.55	1.85	3.49	5.01	5.99	10°
12°	149.46	124.54	99.67	74.82	49.93	24.99	.44	1.42	2.51	3.27	8°
14°	173.89	149.02	124.24	99.49	74.73	49.91	24.99	.33	.98	1.53	6°
16°	197.92	173.11	148.44	123.85	99.27	74.63	49.87	24.98	.22	.55	4°
18°	221.38	196.64	172.11	147.73	123.39	99.01	74.51	49.84	24.98	.11	2°
20°	244.03	219.39	195.04	170.91	146.89	122.86	98.72	74.38	49.79	24.98	
	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	

Projection of long Chords on Tangent.

C. Prolongation of Radius to Tangent.

2°	4°	6°	8°	10°	12°	14°	16°	18°	20°
.11	.55	1.53	3.23	6.04	10.07	15.67	23.24	33.29	46.58

TABLE VI (continued). — 25 Ft Chords. 2° Variation.

D. Long Chords.

	20°	18°	16°	14°	12°	10°	8°	6°	4°	2°	
	25'	49 96	74 85	99 66	124 39	149.06	173.65	198.28	222 88	247 50	20°
2°	30'	25	49 97	74 88	99 73	124 53	149 27	174 02	198 76	223.51	18°
4°	1°30'	1°	25	49 97	74 91	99 80	124 63	149 43	174 32	199 15	16°
6°	3°	2°30'	1°30'	25	49 98	74 93	99 85	124 76	149 66	174 55	14°
8°	5°	4°30'	3°30'	2°	25	49 99	74 95	99 90	124 84	149 79	12°
10°	7°30'	7°	6°	4°30'	2°30'						
						25	49 99	74 97	99 94	124 91	10°
12°	10°30'	10°	9°	7°30'	5°30'	3°	25	49 99	74 98	99 97	8°
14°	14°	13°30'	12°30'	11°	9°	6°30'	3°30'	25	50	74 99	6°
16°	18°	17°30'	16°30'	15°	13°	10°30'	7°30'	4°	25	50	4°
18°	22°30'	22°	21°	19°30'	17°30'	15°	12°	8°30'	4°30'	25	2°
20°	27°30'	27°	26°	24°30'	22°30'	20°	17°	13°30'	9°30'	5°	
	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	

Curvature due to compounding at each end of curve.

E. Tangent length of compounding

2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	
25	50.01	75.06	100.21	125 56	151 30	177 68	205 10	234 12	265.54	

TABLE VII 25 Ft Chords. 1'30 Variation.

A.

	1°30'	3°	4°30'	6°	7°30'	9°	10°30'	12°	13°30'	15°	
	11½'	39½'	1°22½'	2°20½'	3°34'	5° 2'	6°45'	8°43'	10°56½'	13°25'	1°30'
1°30'	11'	22½'	1° 2'	1°56½'	3° 5½'	4°30'	6° 9½'	8° 4'	10°13½'	12°38'	3°
3°	28	22½'	34'	1°24½'	2°30'	3°50½'	5°26½'	7°17'	9°22½'	11°43½'	4°30'
4°30'	52½'	50½'	33½'	45'	1°47'	3° 4'	4°35½'	6°22½'	8°24½'	10°41½'	6°
6°	1°24½'	1°26'	1°13'	45'	56½'	2° 9½'	3°37½'	5°20½'	7°19'	9°30'	7°30'
7°30'	2° 3½'	2° 9½'	2°	1°35½'	56'						
						1° 7½'	2°32'	4°11½'	6° 5½'	8°15'	9°
9°	2°50½'	3°	2°54½'	2°39½'	1°58'	1° 7½'	1°19'	2°54½'	4°45'	6°50½'	10°30'
10°30'	3°45'	3°58'	3°56'	3°39½'	3° 7½'	2°20½'	1°18½'	1°30'	3°17'	5°19'	12°
12°	4°47'	5° 3½'	5° 5½'	4°52½'	4°24½'	3°41'	2°43'	1°30'	1°41½'	3°39½'	13°30'
13°30'	5°56'	6°16½'	6°22½'	6°13'	5°48½'	5° 9½'	4° 15'	3° 5½'	1°41'	1°52½'	15°
15°	7°12½'	7°37'	7°46½'	7°41'	7°20½'	6°45'	5°54½'	4°48½'	3°28'	1°52½'	
	1°30'	3°	4°30'	6°	7°30'	9°	10°30'	12°	13°30'	15°	

TABLE VII (continued). 25 Ft Chords 1°30' Vari

B. Offsets from Tangent to ends of Chords

	15°	13°30'	12°	10°30'	9°	7°30'	6°	4°30'	3
	.82	3.02	6.28	10.27	14.65	19.10	23.30	26.93	29
°30'	25.	.74	2.70	5.55	8.97	12.63	16.20	19.36	21
°	.30	25.	.65	2.37	4.82	7.67	10.61	13.29	15
°30'	74.99	49.99	25.	.57	2.04	4.09	6.37	8.57	10
°	99.95	74.97	49.99	25.	.49	1.72	3.35	5.07	6
°30'	124.87	99.89	74.94	49.98	25.				
						.41	1.39	2.62	3
°	149.70	124.74	99.82	74.90	49.96	25.	.31	1.06	1
°30'	174.38	149.44	124.57	99.71	74.85	49.95	24.99	.25	
°	198.83	173.93	149.12	124.35	99.59	74.79	49.93	24.99	
°30'	222.96	198.10	173.37	148.72	124.10	99.45	74.72	49.91	24
°	246.63	221.83	197.20	172.69	148.24	123.79	99.28	74.65	49
	10°30'	9°	7°30'	6°	4°30'	3°	1°30'	12°	13

TABLE VII (continued). — 25 Ft Chords. 1°30' Variation.

D. Long Chords.

	15°	13°30'	12°	10°30'	9°	7°30'	6°	4°30'	3°	1°30'	
	25.	49.98	74.91	99.81	124.65	149.47	174.25	199.03	223.80	248.60	15°
1°30'	22½	25.	49.99	74.93	99.85	124.74	149.60	174.45	199.29	224.16	13°30'
3°	1° 7½'	45'	25.	49.99	74.95	99.89	124.80	149.71	174.61	199.53	12°
4°30'	2°15'	1° 52½'	1° 7½'	25.	49.99	74.96	99.92	124.87	149.80	174.75	10°30'
6°	3°45'	3° 22½'	2°37½'	1°30'	25.	49.99	74.97	99.95	124.91	149.88	9°
7°30	5°37½'	5° 15'	4°30'	3°22½'	1°52½"						
						25.	49.99	74.98	99.97	124.95	7°30'
9°	7°52½	7°30'	6°45'	5°37½	4° 7½'	2° 15'	25.	50.	74.99	99.98	6°
10°30'	10°30'	10° 7½	9°22½	8°15'	6°45'	4°52½	2°37½	25.	50.	75.	4°30'
12°	13°30'	13° 7½	12°22½	11°15'	9°45'	7°52½	5°37½	3°	25	50	3°
13°30'	16°52½	16°30'	15°45'	14°37½	13° 7½	11°15'	9°	6°22½	3°22½	25.	1°30'
15°	20°37½	20°15'	19°30'	18°22½	16°52½	15°	12°45'	10° 7½	7° 7½	3°45	
	1°30'	3°	4°30'	6°	7°30'	9°	10°30'	12°	13°30'	15°	

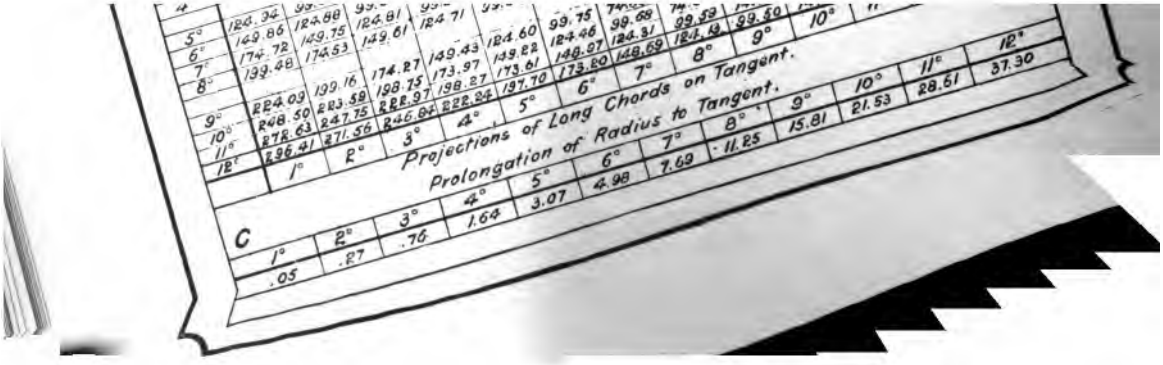
Curvature due to compounding at each end of curve.

E. Tangent length of compounding.

1°30'	3°	4°30'	6°	7°30'	9°	10°30'	12°	13°30'	15°	
25.	50.01	75.03	100.11	125.31	150.73	176.50	202.82	229.99	258.36	

TABLE VIII 25 Ft Chords. 1° Variation.

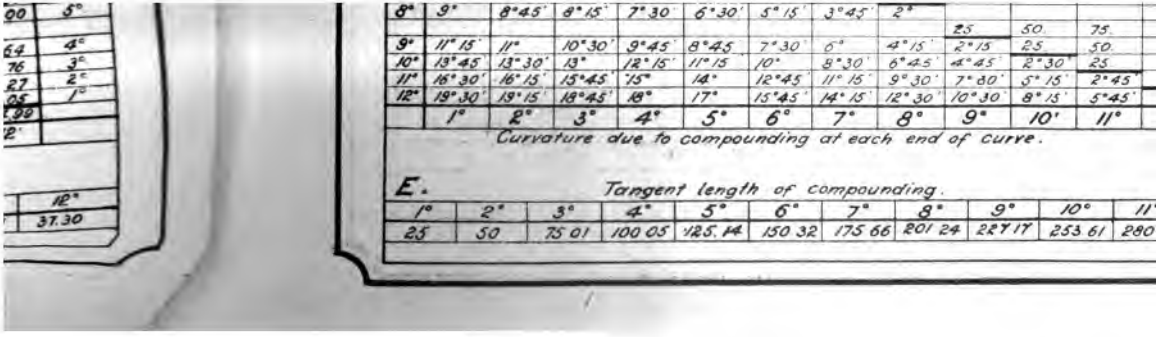
1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°
7½'	16'	24'	1°.34	2°.82½	3°.21'	4°.30'	5°.49'	7°.17½	8°.58½	10°.4
7½'	15'	41'	1°.17½	2°.4'	3°	4°.6'	5°.08½	6°.49'	8°.25'	10°.1
10'	15'	22½'	56'	1°.40'	2°.24'	3°.37½	4°.51'	6°.15'	7°.49'	9°.3
25'	34'	22½'	49'	1°.11'	2°.8½	3°.4'	4°.15'	5°.26½	7°.7½	8°.4
50'	37½'	49	30							
				37½'	1°.26'	2°.24'	3°.24'	4°.32½	6°.21½	8°
1°.22½'	1°.26'	1°.20'	1°.4	37½'	45'	1°.41'	2°.27½	4°.4'	5°.30'	7°.0
1°.56'	2°	1°.56'	1°.42½	1°.19'	45'	58½'	1°.56'	3°.10'	4°.34'	6°.1
2°.30'	2°.59'	2°.37½	2°.26'	2°.5'	1°.34'	52½'	1°	2°.11'	3°.38½	5°.
3°.11'	3°.22½	3°.24'	3°.15'	2°.56'	2°.27½	1°.48'	1°			
								1°.7½	2°.26'	3°.
3°.57½	4°.11'	4°.15'	4°.8½	3°.52½	3°.26'	2°.30'	2°.4'	1°.7½	1°.15'	2°.
		5°.11'	5°.7½	4°.33½	4°.30'	3°.56'	3°.12½	2°.19'	1°.15'	1°.
				2°	5°.38½	5°.7½	4°.26'	3°.35'	2°.34'	1°.
							5°.45'	4°.56'	3°.57½	2°



Projections of Long Chords on Tangent.

Prolongation of Radius to Tangent.

C	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°
1°	.05	.27	.76	1.64	3.07	4.98	7.69	11.25	15.81	21.53	28.61	37.30



8°	9°	8°45'	8°15'	7°30	6°30'	5°15'	3°45'	2°				
									25	50	75	
9°	11°15'	11°	10°30'	9°45	8°45	7°30'	6°	4°15'	2°15	25	50	
10°	13°45'	13°30'	13°	12°15'	11°15	10°	8°30'	6°45'	4°45'	2°30'	25	
11°	16°30'	16°15'	15°45'	15°	14°	12°45'	11°15'	9°30'	7°30'	5°15'	2°45'	
12°	19°30'	19°15'	18°45'	18°	17°	15°45'	14°15'	12°30'	10°30	8°15'	5°45'	
	1°	2°	3°	4°	5°	6°	7°	8°	9°	10'	11°	

Curvature due to compounding at each end of curve.

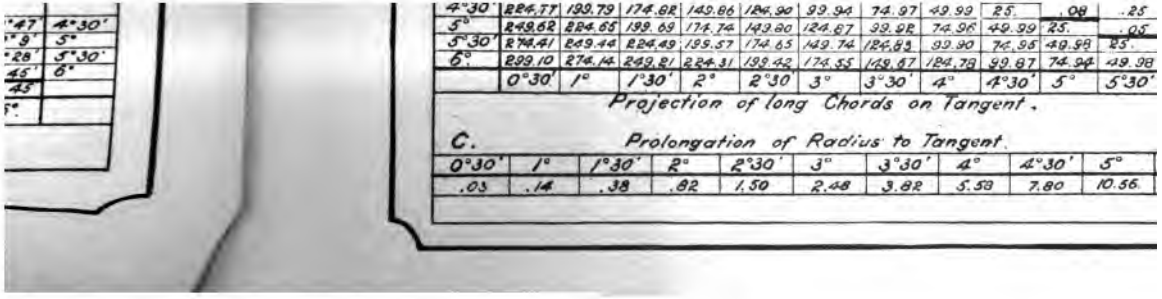
E. Tangent length of compounding.

1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11
25	50	75 01	100 05	125. 14	150 32	175 66	201 24	227 17	253 61	280

TABLE IX.— 25 Ft Chords. 30' Vari

A.

	0°30'	1°	1°30'	2°	2°30'	3°	3°30'	4°	4°3
	4"	8"	87½"	47"	1' 11½"	1'40½"	2' 15"	2'54½"	3'3
0°30'	3½"	7½"	20½"	39"	1' 2"	1' 30"	2' 3"	2'41½"	3'2
1°	3½"	7½"	11½"	28"	50"	1' 17"	1'49"	2'26½"	3'7
1°30'	17½"	17"	11"	15"	35½"	1' 1½"	1'38"	2' 7½"	2'4
2°	28"	28½"	24¼"	15"					
					19"	43"	1'12½"	1'47"	2'2
2°30'	41"	43"	40"	32"	18½"	22½"	30½"	1' 24"	2'
3°	57"	1'	58"	51"	39½"	22½"	26½"	58"	1'4
3°30'	1' 15"	1'19½"	1' 18½"	1' 13"	1' 2½"	47"	26"	30"	1'3
4°	1'35½"	1'41"	1' 42"	1' 37½"	1' 28"	1' 13½"	54½"	30"	



4°30'	224.77	199.79	174.82	149.86	124.90	99.94	74.97	49.99	25.	.08	.25
5°	249.62	224.65	199.69	174.74	149.80	124.87	99.92	74.96	49.99	25.	.05
5°30'	274.41	249.44	224.49	199.57	174.65	149.74	124.83	99.90	74.95	49.98	25.
6°	299.10	274.14	249.21	224.31	199.42	174.55	149.67	124.78	99.87	74.94	49.98
	0°30'	1°	1°30'	2°	2°30'	3°	3°30'	4°	4°30'	5°	5°30'

Projection of long Chords on Tangent.

C. Prolongation of Radius to Tangent.

0°30'	1°	1°30'	2°	2°30'	3°	3°30'	4°	4°30'	5°
.03	.14	.38	.82	1.50	2.48	3.82	5.53	7.80	10.56

TABLE IX. (continued).— 25 Ft Chords. 30' Variation.

D. Long Chords.

	6°	5°30'	5°	4°30'	4°	3°30'	3°	2°30'	2°	1°30'	1°	0°30'	
	25.	50.	74.99	99.97	124.94	149.91	174.86	199.82	224.77	249.72	274.66	299.62	6°
0°30'	7/8	25	50.	74.99	99.97	124.95	149.92	174.89	199.86	224.82	249.79	274.75	5°30'
1°	22/8	13'	25	50.	74.99	99.98	124.96	149.94	174.92	199.89	224.87	249.84	5°
1°30'	45'	37/8	22/8	25.	50.	74.99	99.98	124.97	149.96	174.94	199.92	224.91	4°30'
2°	1°15'	1°7/8	52/8	30'									
					25.	50.	74.99	99.99	124.98	149.97	174.96	199.95	4°
2°30'	1°52/8	1°45'	1°30'	1°7/8	37/8	25.	50.	75.	99.99	124.98	149.98	174.97	3°30'
3°	2°37/8	2°30'	2°15'	1°52/8	1°22/8	45'	25.	50.	75.	99.99	124.99	149.99	3°
3°30'	3°30'	3°22/8	3°7/8	2°45'	2°15'	1°37/8	52/8	25.	50.	75.	100.	124.95	2°30'
4°	4°30'	4°22/8	4°7/8	3°45'	3°15'	2°37/8	1°52/8	1°					
									25.	50.	75.	100.	2°
4°30'	5°37/8	5°30'	5°15'	4°52/8	4°22/8	3°45'	3°	2°7/8	1°7/8	25	50.	75.	1°30'
5°	6°52/8	6°45'	6°30'	6°7/8	5°37/8	5°	4°15'	3°22/8	2°22/8	1°15'	25	50.	1°
5°30'	8°15'	8°7/8	7°52/8	7°30'	7°	6°22/8	5°37/8	4°45'	3°45'	2°37/8	1°22/8	25.	0°30
6°	9°45'	9°37/8	9°22/8	9°	8°30'	7°52/8	7°7/8	6°15'	5°15'	4°7/8	2°52/8	1°30'	
	0°30'	1°	1°30'	2°	2°30'	3°	3°30'	4°	4°30'	5°	5°30'	6°.	

Curvature due to compounding at each end of curve.

E. Tangent length of compounding.

0°30'	1°	1°30'	2°	2°30'	3°	3°30'	4°	4°30'	5°	5°30'	6°
25	50	75	100.01	125.03	150.08	175.16	200.31	225.54	250.89	276.40	302.14.

TABLE X.

A.

	0°15'	0°30'	0°45'	1°
	2'	6½'	14'	2.
0°15'	2'	4'	10½'	1
0°30'	4½'	3½'	5½'	1
0°45'	8½'	8½'	5½	7
1°	14'	14½'	12'	7
1°15'	20½	21½	20'	1
1°30'	28½	30'	29'	2
1°45'	37½	39½	39½	3
2°	48'	50½	51'	4
2°15'	59½	1° 3'	1° 3½	1°
2°30'	1° 12'	1° 16'	1° 18'	1°
2°45'	1° 26'	1° 31'	1° 33'	1° 3
3°	1° 41½	1° 47'	1° 49½	1° 5
	0°15'	0°30'	0°45'	1°

2°45	274.85	249.86	224.87	199.89	174.91	149.94	124.96	99.98	74.99	50.	25.	.01	0°15'
3°	299.78	274.78	249.80	224.83	199.86	174.89	149.92	124.95	99.97	74.99	50.	25.	
	0°15'	0°30'	0°45'	1°	1°15'	1°30'	1°45'	2°	2°15'	2°30'	2°45'	3°	

Projection of long Chords on Tangent.

C. Prolongation of Radius to Tangent.

0°15'	0°30'	0°45'	1°	1°15'	1°30'	1°45'	2°	2°15'	2°30'	2°45'	3°
.01	.07	.19	.41	.75	1.24	1.91	2.78	3.89	5.26	6.91	8.89

TABLE X. (continued).— 25 Ft Chords. 15' Variation.

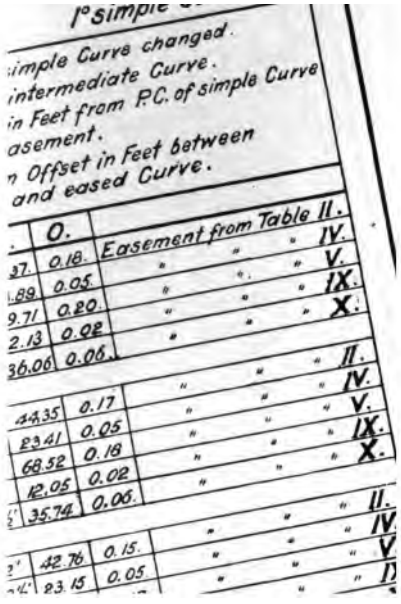
D. Long Chords.

	3°	2°45'	2°30'	2°15'	2°	1°45'	1°30'	1°15'	1°	0°45'	0°30'	0°15'	
	25.	50.	74.99	99.99	124.98	149.98	174.97	199.95	224.94	249.93	274.92	299.91	3°
0°15'	3¾'	25.	50.	75.	99.99	124.99	149.98	174.97	199.96	224.96	249.95	274.94	2°45'
0°30'	11¼'	7½'	25.	50.	75.	99.99	124.99	149.99	174.98	199.97	224.97	249.96	2°30'
0°45'	22½'	18¾'	11¼'	25.	50.	75.	100.	124.99	149.99	174.99	199.98	224.97	2°15'
1°	37½'	33¾'	26¼'	15'									
					25.	50.	75.	100.	124.99	149.99	174.99	199.99	2°
1°15'	56¼'	52½'	45'	33¾'	18¾'	25.	50.	75.	100.	125.	149.99	174.99	1°45'
1°30'	1°18¾'	1°15'	1°7½'	56¼'	41¼'	22½'	25.	50.	75.	100.	125.	150.	1°30'
1°45'	1°45'	1°41¼'	1°33¾'	1°22½'	1°7½'	48¾'	26¼'	25.	50.	75.	100.	125.	1°15'
2°	2°15'	2°11¼'	2°3¾'	1°52½'	1°37½'	1°18¾'	56¼'	30'					
									25.	50.	75.	100.	1°
2°15'	2°48¾'	2°45'	2°37½'	2°26¼'	2°11¼'	1°52½'	1°30'	1°3¼'	33¾'	25.	50.	75.	0°45'
2°30'	3°26¼'	3°22½'	3°15'	3°3¾'	2°48¾'	2°30'	2°7½'	1°41¼'	1°11¼'	37½'	25.	50.	0°30'
2°45'	4°7½'	4°3¾'	3°56¼'	3°45'	3°30'	3°11¼'	2°48¾'	2°22½'	1°52½'	1°18¾'	41¼'	25.	0°15'
3°	4°52½'	4°48¾'	4°41¼'	4°30'	4°15'	3°56¼'	3°33¾'	3°7½'	2°37½'	2°3¾'	1°26¼'	45'	
	0°15'	0°30'	0°45'	1°	1°15'	1°30'	1°45'	2°	2°15'	2°30'	2°45'	3°	

Curvature due to compounding at each end of curve.

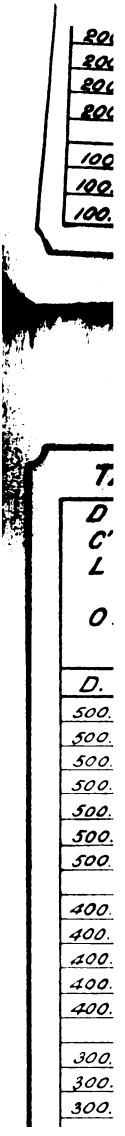
E. Tangent length of compounding.

0°15'	0°30'	0°45'	1°	1°15'	1°30'	1°45'	2°	2°15'	2°30'	2°45'	3°
25	50	75	100	125.01	150.02	175.04	200.08	225.13	250.22	275.35	300.54



1° simple
simple Curve changed.
intermediate Curve.
in Feet from P.C. of simple Curve
asement.
n Offset in Feet between
and eased Curve.

	O.	
37.	0.18.	Easement from Table II.
1.88	0.05.	" " " IV.
9.71	0.20.	" " " V.
2.13	0.02	" " " IX.
36.06	0.06.	" " " X.
		" " " II.
44.35	0.17	" " " IV.
23.41	0.05	" " " V.
68.52	0.18	" " " IX.
12.05	0.02	" " " X.
35.74	0.06.	
		" " " II.
42.76	0.15.	" " " IV.
23.15	0.05	" " " V.
		" " " IX.


D.
500.
500.
500.
500.
500.
500.
500.
400.
400.
400.
400.
400.
300.
300.
300.

III. 3° simple Curve.

of simple Curve changed.
of intermediate Curve.
e in Feet from P.C. of simple Curve
r Easement.
um Offset in Feet between
l and eased Curve.

L.	O.	
18.99	1.13	Easement from Table I. III.
17.01	0.36	" " " IV.
13.41	1.31	" " " VII.
12.22	0.04	" " " VIII.
24.26	0.10	" " " IX.
59.29	0.39	" " " X.
125.86	1.34	"

87.71	1.07	" " " I.
46.91	0.34	" " " III.
111.15	1.20	" " " IV.
		" " " VII.
		" " " VIII.

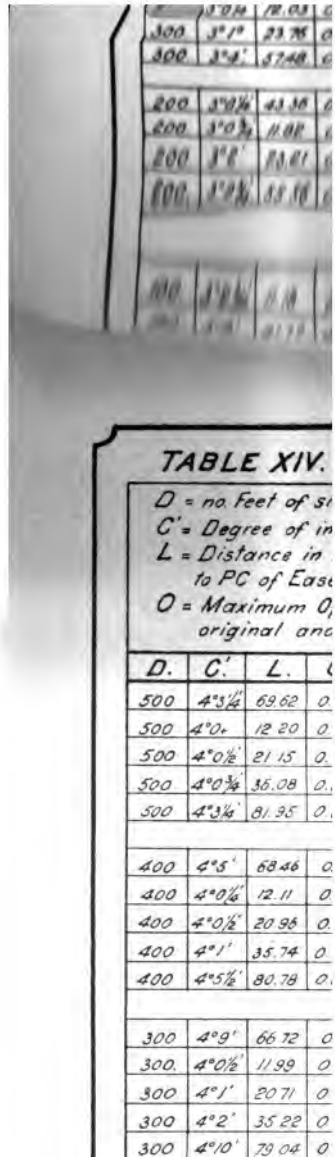


TABLE XIV.

D = no. Feet of st
C' = Degree of in
L = Distance in
to PC of Easi
O = Maximum O,
original and

D.	C'.	L.	O
500	4°5 1/4'	69.62	0.
500	4°0'	12.20	0.
500	4°0 1/2'	21.15	0.
500	4°0 3/4'	36.08	0.
500	4°3 1/4'	81.35	0.
400	4°5'	68.46	0.
400	4°0 1/4'	12.11	0.
400	4°0 1/2'	20.96	0.
400	4°1'	35.74	0.
400	4°5 1/2'	80.78	0.
300	4°9'	66.72	0.
300	4°0 1/2'	11.99	0.
300	4°1'	20.71	0.
300	4°2'	35.22	0.
300	4°10'	79.04	0.

TABLE XV. 5°S

D = no Feet of simple Cur
C' = Degree of intermedia
L = Distance in Feet fron
to P.C. of Easement.
O = Maximum Offset in
original and eased

D.	C.	L.	O.	
500.	5°6½'	91.79	1.69	Ea
500.	5°0⅞'	19.33	0.14	
500.	5°0¾'	28.89	0.23	
500.	5°1½'	47.73	0.45	
500.	5°6¾'	104.20	1.64	
400	5°10½'	90 11	1.48	
400.	5°0⅝'	19.18	0.14	
400	5°1¼'	28.64	0.21	
400.	5°2¼'	47 22	0.43	
400	5°11'	102.49	1 54	
300	5°1⅛'	18.92	0.13	
300.	5°2'	28 25	0 20	
300.	5°4½'	46.43	0.40	
200.	5°2¾'	18 43	0 12	
200.	5°4¾'	27 51	0.19	
200.	5°10½'	44.97	0.37	

300.	5°4½'	46.43	0.40
200.	5°2¾'	18.43	0.12
200.	5°4¾'	27.51	0.19
200.	5°10½'	44.97	0.37

TABLE XVI.

D = no. Feet of simple
C' = Degree of interme
L = Distance in Feet f
to P.C. of Easement
O = Maximum Offset
original and eas

D.	C'.	L.	O.	
500.	6°12'	113.61	2.64	Ec
500.	6°½'	24.19	0.19	
500	6°¾'	36.43	0.37	
500.	6°2¾'	59.29	0.77	
500.	6°12¾'	126.06	2.65	
400.	6°18'	111.65	2.46	
400	6°1'	24.08	0.19	
400	6°2½'	36.19	0.37	
400.	6°4¼'	58.58	0.76	
400.	6°20¼'	123.88	2.42	
300.	6°2'	23.50	0.18	
300.	6°3¼'	35.17	0.32	
300.	6°8'	57.52	0.70	

TABLE XVII. 7° simple Curve.

D = no. Feet of simple Curve changed.
C' = Degree of intermediate Curve.
L = Distance in Feet from P.C. of simple Curve to P.C. of Easement.
O = Maximum Offset in Feet between original and eased Curve.

D.	C.'	L.	O.	
500	7°20'	135.14	4.00	Easement from Table III.
500	7°1¼'	30.94	0.35	" " " VI.
500	7°2'	44.51	0.58	" " " VII.
500	7°3¾'	70.76	1.20.	" " " VIII.
400.	7°21'	30.64	0.33.	" " " VI.
400	7°3½'	43.94	0.56.	" " " VII.
400.	7°7'.	69.82	1.14.	" " " VIII.
300.	7°3½'	30.20	0.31	" " " VI.
300	7°5½'	43.27	0.54.	" " " VII.
300	7°13'.	68.38	1.04.	" " " VIII.
200	7°7⅜'	29.38	0.29	" " " VI.
200	7°13½'	41.93	0.46.	" " " VII.

TABLE XVIII. 7°30' simple Curve.

D = no. Feet of simple Curve changed
C' = Degree of intermediate Curve
L = Distance in Feet from P.C. of simple Curve to P.C. of Easement.
O = Maximum Offset in Feet between original and eased Curve.

D.	C'.	L.	O.	
500	7°53¾'	148.1	5.84	Easement from Table III.
500	7°31½'	33.66	0.41	" " " VI.
500	7°32½'	47.79	0.67	" " " VII.
500	7°35¾'	76.83	1.46	" " " VIII.
400	7°32½'	33.32	0.39	" " " VI.
400	7°33¾'	47.26	0.65	" " " VII.
400	7°38¾'	75.77	1.42	" " " VIII.
300	7°35½'	32.81	0.36.	" " " VI.
300	7°36½'	46.45	0.62	" " " VII.
300	7°47¼'	74.20	1.32	" " " VIII.
200	7°39'	31.88	0.31	" " " VI.
200	7°45¼'	46.33	0.61	" " " VII.

E APPLICATION OF SERVIS TIE PLATES TO SWITCH LAY-OUTS

aving, in the previous chapters, diagrams and tables, given de-
instructions for the accurate laying out and proper putting in of
ies, we herein present a few hints as to how, under the heaviest
, with little expense for labor, the good work can be made to stand.
is to the permanency of the work that the considerations of safety,
ncy and economy relate.
n our switching yards, the labor of track repairs is very costly. The
ency of trains results in constant interruption to the trackmen, and
ch work can only be done at the expense of delay to traffic, which
the protection of trainmen, the ballast filling in

yards is kept full up, thus impairing the surface drainage of same, which tends to keep the ties soft and more liable to cut, while the deficient drainage leads to the churning of the ties, which is aggravated by the cutting of rails. The labor of changing switch sets in our busy yards, by accurate records kept, costs from 30c. to more than $1.50 per tie.

The conditions above stated all tend to that general looseness of parts which characterizes the tracks of many of our leading yards and makes constant tinkering necessary to preserve safe, when reasonably good track at less cost for labor could be obtained.

Where physical conditions are unfavorable and work on track is subject to constant interference of traffic, as in yards, the application of devices which supplement and afford a substitute for labor add greatly to the efficiency and economy of maintenance. It is this experience which has led many lines to adopt the Servis Tie Plates for the protection of ties in switch lay-outs and switching tracks, and thereby better track has been attained at greatly reduced cost for both labor and material. Switch sets, which formerly cut out in eighteen months and two years, have been pro-

tected with plates for more than three years and give promise of continued service until decay.

The plates render the use of rail braces unnecessary; they hold the track to gauge and the rail does not cant or cut into the tie, while, by preventing the cutting-in of the tie, the pumping action of the rail is arrested and the churning of ties is minimized. These considerations will at once suggest the saving of labor resulting from their use, viz.: less frequent changing of ties, no adzing of ties or rolling up of rails, while regauging of the track is avoided.

In busy yards the life of ties and switch and frog sets can be prolonged to their natural lives, as the ties are protected from the cutting action of the rail and frequent spiking for regauging is avoided. The life of rails is preserved by holding them perpendicular to the plane of the tie, by which means the excessive side head wear is prevented In addition to this, a general saving in labor and material is secured by the perfected fastening which the plate affords, thereby correcting the gen-

Plates should be driven home when applied, and a tool for this work is furnished at cost.

Upon application to the Q. & C. Company, of Chicago and New York,

who are the manufacturers, references will be given covering any application desired, viz.: to switch and frog sets, yard curves, under planking of street crossings, station platforms, etc., and for general yard purposes.

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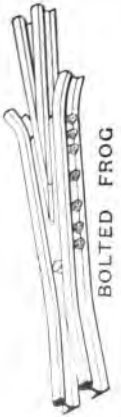
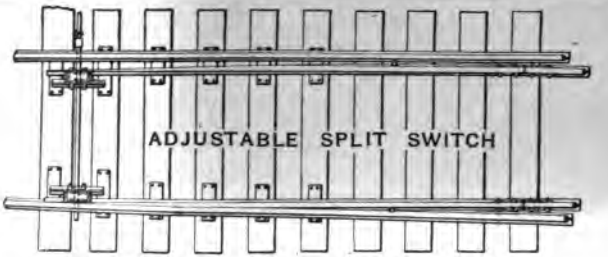


BOLTED FROG



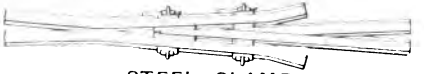
ADJUSTABLE SPLIT SWITCH

ELLIOT FROG & SWITCH CO.,

EAST ST. LOUIS, ILLS.

"EUREKA" SPRING RAIL FROG

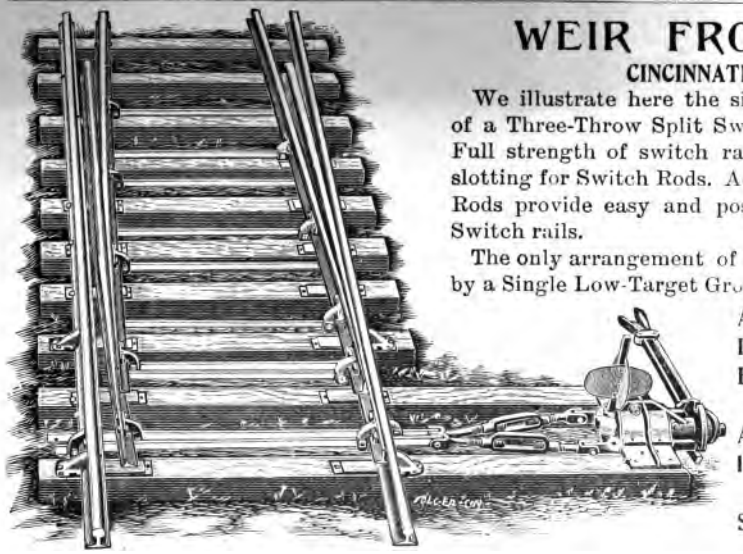
"EUREKA" SPRING RAIL FROG



STEEL CLAMP FROG

WITH SAFETY CAP

HIGH MAIN LINE STAND



WEIR FROG CO.'S THREE-THROW SPLIT SWITCH WITH LOW STAND.

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We illustrate here the simplest arrangement of a Three-Throw Split Switch on the market. Full strength of switch rails, no weakening by slotting for Switch Rods. Adjustable Connecting Rods provide easy and positive adjustment of Switch rails.

The only arrangement of this device operated by a Single Low-Target Ground-Throw Stand.

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Improved Spring Frogs.
Bolted and Clamped Rigid Frogs.
Automatic "Clutchless" Spring Switch Stands.
Steel Die Formed Rail Braces.

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JOSEPH F. McCOY CO.
JIM CROW RAIL BENDER
WROUGHT IRON AND STEEL.
Five Sizes in Stock for 20 to 90 lb. Steel Rails.
... ALSO ...
HYDRAULIC RAIL BENDERS
TRACK GUAGES AND TRACK LEVELS.
TRACK JACKS AND DRILLS
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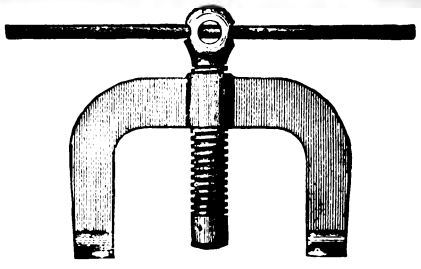


THE TRUSS RAIL JOINT

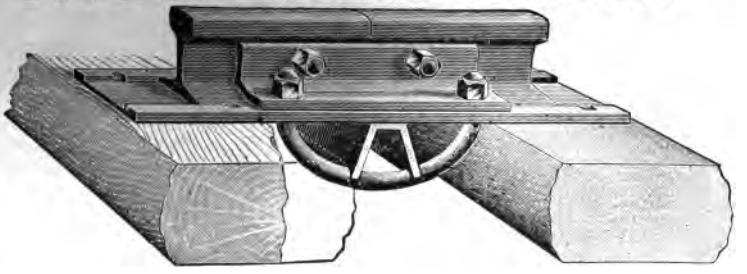
References by Permission:

C. & N. W. RY.

C. M. & ST. P. RY.

C. ST. P. M. & O. RY.

F. & P. M. RY.



IT COMBINES STRENGTH AND FLEXIBILITY.

SEVEN YEARS practical test of **5 Miles** of these Joints proves that it adds **25 per cent. to the LIFE** of the Rails, and reduces cost of maintenance of Joints 40 per cent.

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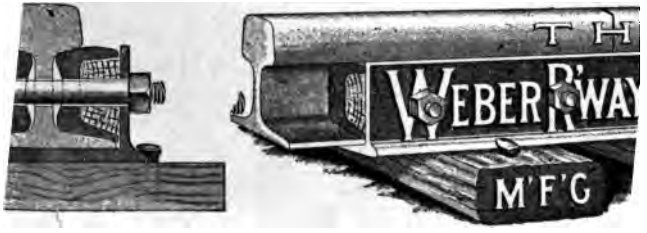
Orders, 1896: 3½ miles—30,000 joints. C. & N W., 36 miles; Mich. Cent., 27½ miles; C. & Blue Isd., 20 miles.

STANDARD



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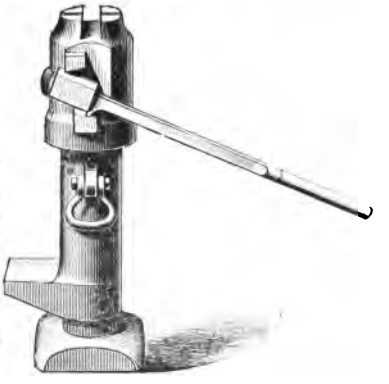
"The advantages over the 1873 patent may be summarized as follows: More perfect action, increased durability, and greater ease in repairing."



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